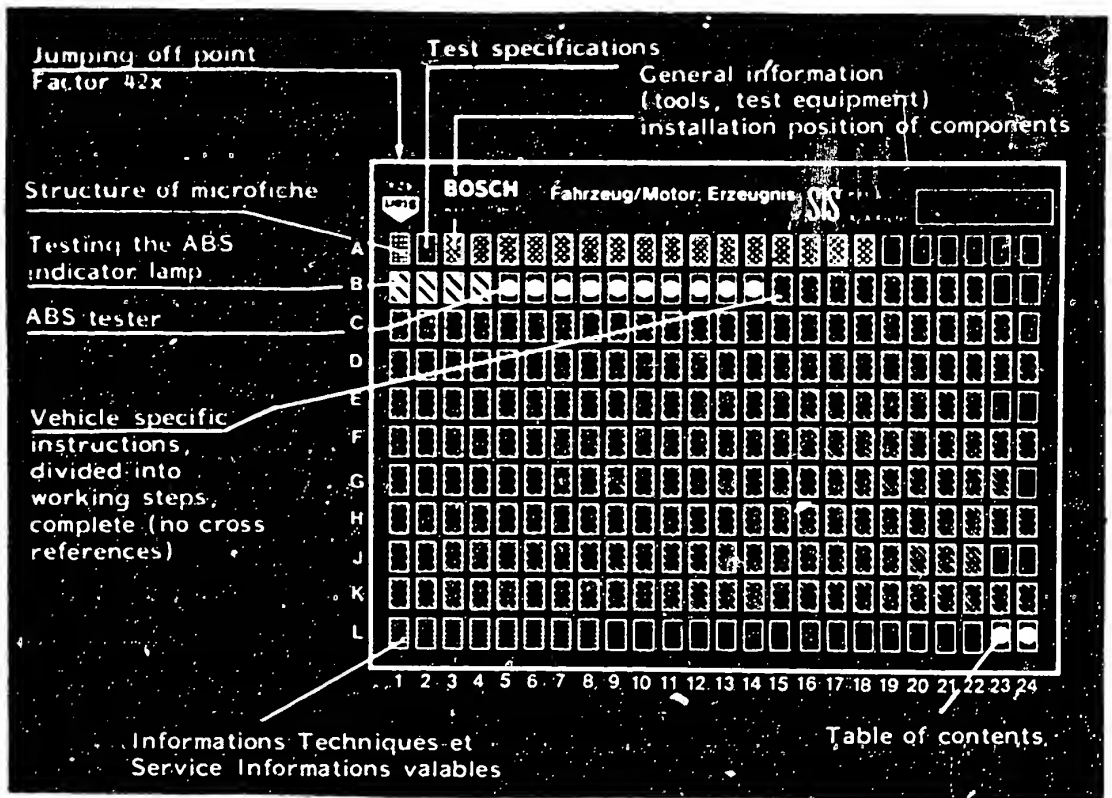


Microfiche layout

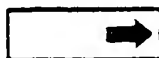


1. Read from left to right
2. Title of microfiche (appears on each coordinate)

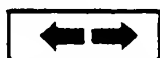
E16	Product/assembly/test step	
	Vehicle/engine	

Coordinate

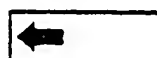
3. Limits of section



Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.
5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

A1

Trouble-Shooting Plan



1. Test specifications

For reasons of safety, the ABS must only be tested using the ABS tester (test starting on Coordinate B 1).

The test program contains all the important information on testing and replacing the components.



2. Necessary test equipment and tools

ABS tester ETT 016.00 0 684 101 600

Adapter cable
for connection of 4-channel controller 1 684 463 107

Dynamic brake analyzer e.g. BPS 100 0 680 012 ..
or BPS 101 0 680 013 ..
or BPS 104 0 680 018 ..
or BPS 105 0 680 019 ..

Charging and bleeding device e.g. ATE Part No. 1)
3.9302-1000.4

Bleeder connection ATE Part No.
for connecting the charging 3.9302-0702.2¹⁾
and bleeding device to the
fluid reservoir of the master
cylinder

Bleeder hose ATE Part No.
3.3590-2300.1¹⁾

Auxiliary hose ATE Part No.
3.9302-0704.2¹⁾

Brake-pedal actuating device ATE Part No.
3.9312-0100.4¹⁾



Pressure tester

e.g. ATE Part No.
3.9305-0200.4¹⁾

Tester for low and high
pressure testing of
hydraulic brake systems

Double-end flare nut wrench, 9x11 mm Hazet Part No.612²⁾

Vessel for catching the brake fluid approx. 1 l[°]

Brake fluid

BMW-DOT 4
or ATE SL-DOT 4
or Veedol Disc Brake Fluid DOT 4
or Castrol Disc Brake Fluid DOT 4

Electrics tester ETE 014.00

0 684 101 400

or

Multimeter

for trouble-shooting

Commercially available

1) Obtainable from

Alfred Teves GmbH
Guerickestr. 7

6000 Frankfurt/M.

2) Fa. Hazet

5630 Remscheid

A 4

Test equipment and tools

BMW 7 series



Depth gauge
for adjusting wheel-speed sensors

KDAS 0001

Calliper-type depth gauge

Commercially available

Micrometer screw

Commercially available

Dial indicator
dia. approx. 30 mm, measuring
range 3 mm,
0.01 mm graduations

Commercially available

2.2 Auxiliary materials

Use only BMW genuine brake lines.

<u>Description</u>	<u>Number</u>
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	Bosch Part No. 1 900 508 002 (100 pieces)
Protective caps for connection of brake lines to hydraulic modulator	Bosch Part No. 1 900 508 004 (100 pieces)

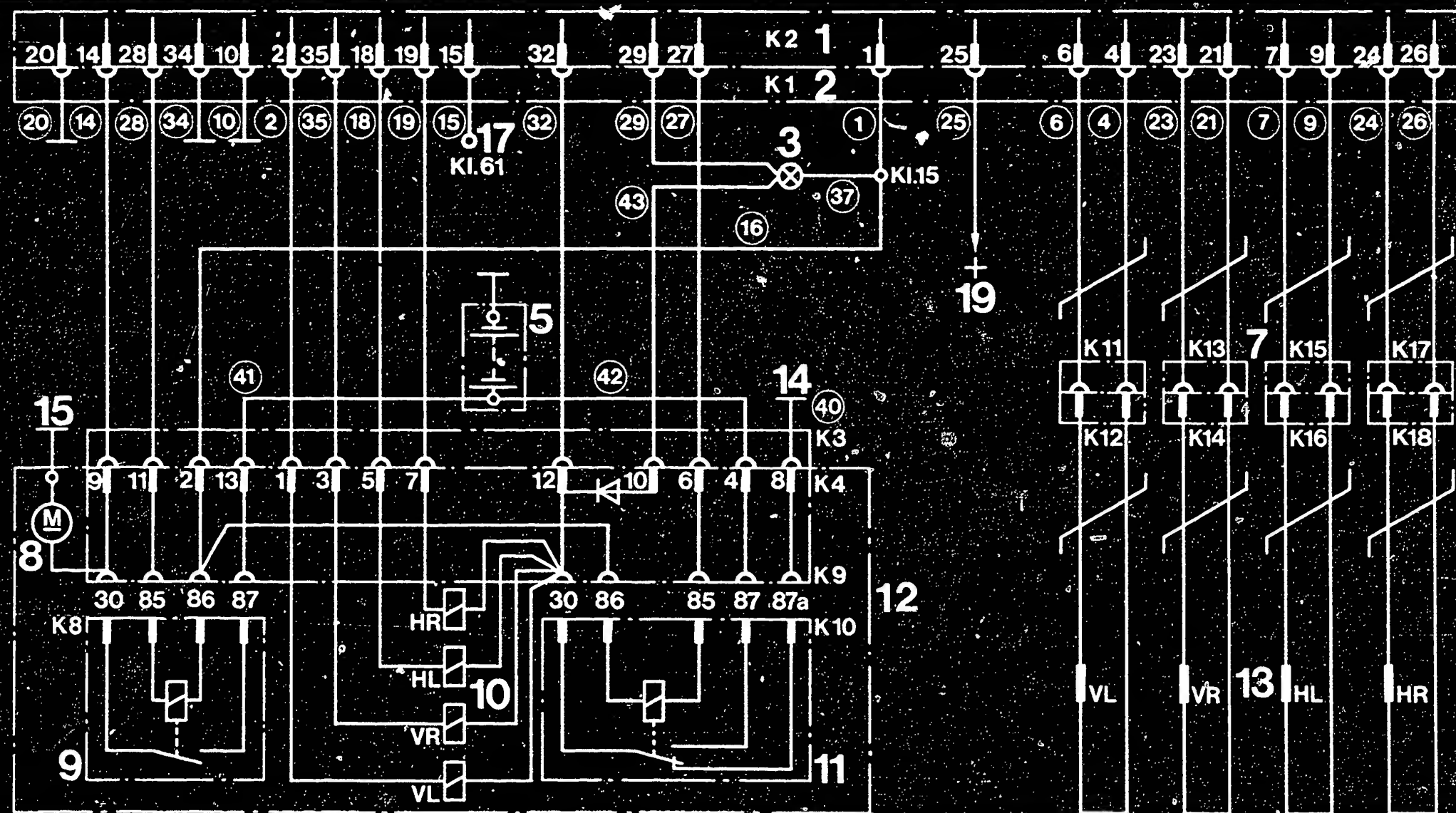


Description	BMW Number
Brake line, brake master cylinder - hydraulic modulator Circuit I	34.51-1 150 585.9
Brake line, brake master cylinder - hydraulic modulator Circuit II	34.51-1 150 587.9
Brake line, hydraulic modulator - front left wheel	34.51-1 150 589.9
Brake line, hydraulic modulator - front right wheel	34.51-1 150 591.9
Brake line, hydraulic modulator - adapter rear left	34.51-1 150 595.9
Brake line, hydraulic modulator - adapter rear right	34.51-1 150 593.9
Adapter for brake line	34.51-1 119 123.4
Rubber sleeve for wheel-speed sensor	34.51-1 121 576.3



Description	BMW Number
<u>Shim rings for wheel-speed sensor</u> thickness 2.0 mm 2.1 mm 2.2 mm 2.3 mm 2.4 mm 2.5 mm 2.6 mm 2.7 mm 2.8 mm 2.9 mm 3.0 mm 3.1 mm 3.2 mm	34.51-1 150 510.9 34.51-1 150 511.9 34.51-1 150 512.9 34.51-1 150 513.9 34.51-1 150 514.9 34.51-1 150 515.9 34.51-1 150 516.9 34.51-1 150 517.9 34.51-1 150 518.9 34.51-1 150 519.9 34.51-1 150 520.9 34.51-1 150 521.9 34.51-1 150 522.9
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	Bosch Part No. 1 900 508 002 (100 pieces)
Protective caps for connection of brake lines to hydraulic modulator	1 900 508 004 (100 pieces)





265/0065

3. Electrical circuit diagram of ABS

- 1 = Electronic controller
- 2 = Multiple plug (35-pin)
- 3 = ABS indicator lamp
- 5 = Battery
- 7 = Plug-in connectors
- 8 = Return-pump motor
- 9 = Return-pump relay
- 10 = Solenoid-operated valves

- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Wheel-speed sensor
- 14 = Ground terminal under fuse box
- 15 = Ground terminal in engine compartment on left
- 17 = To alternator

- 19 = To stop-lamp switch (as of generation 2B)
- VL = Front left
- VR = Front right
- HL = Rear left
- HR = Rear right
- K1, K2 etc. = Connector numbers

A8

Electrical circuit diagram
BMW 7 series



A9

Electrical circuit diagram
BMW 7 series

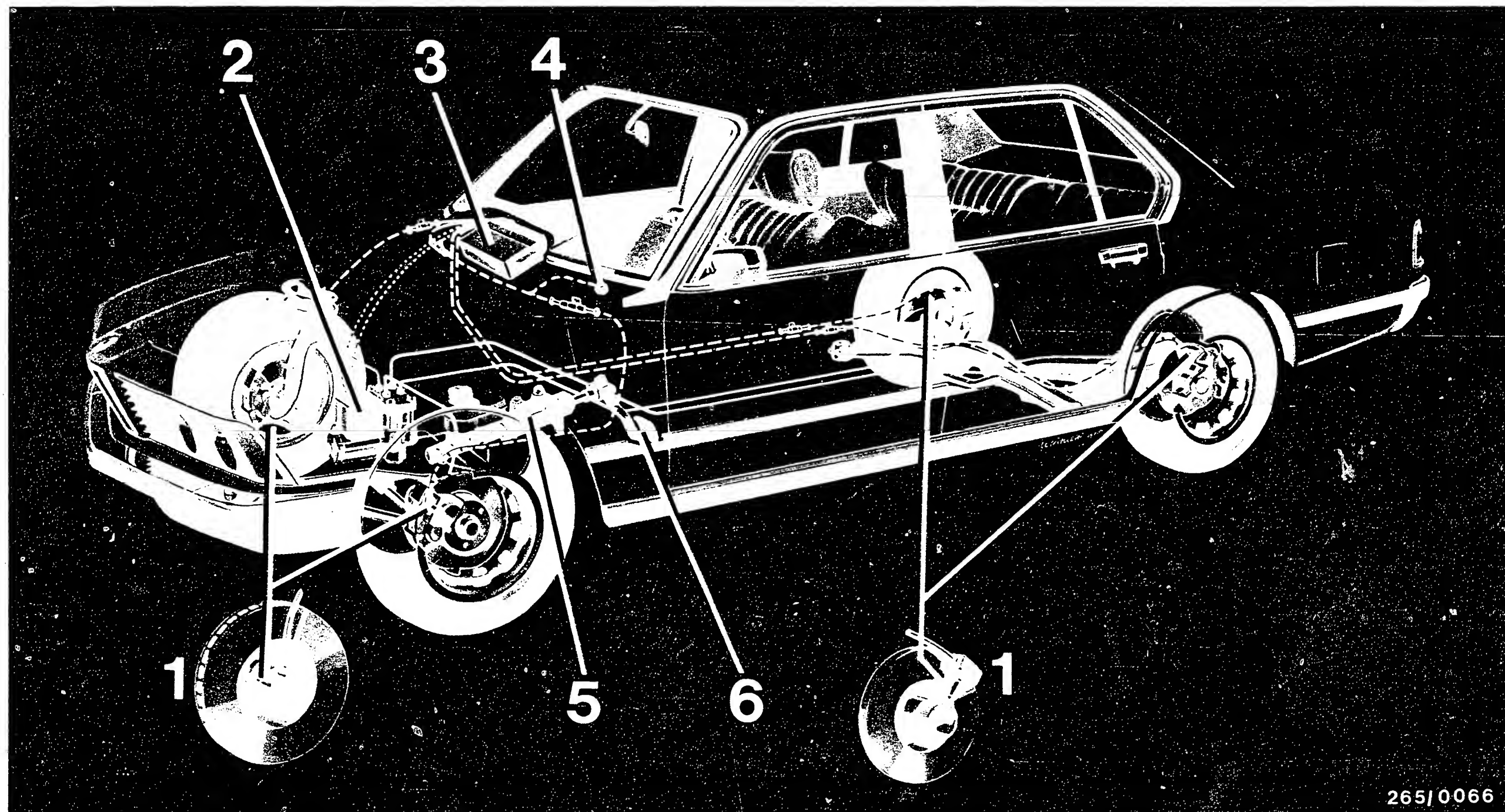


4. Installation position of components

The indications "right" and "left" always refer to the forward direction of travel.

- ABS indicator lamp: In instrument panel
- Front-axle wheel-speed sensors: One at both left and right in the steering knuckles
- Rear-axle wheel-speed sensors: One at both left and right near the brake callipers
- Hydraulic modulator: In engine compartment on left-hand side in front of brake master cylinder
- Ground terminal for ABS: Under fuse box
- Controller: On right above glove compartment





- 1 = 4 wheel-speed sensors on wheels
 2 = Hydraulic modulator in engine compartment
 3 = Controller in glove compartment

Installation position of components

- 4 = Indicator lamp in instrument panel
 5 = Tandem brake master cylinder
 6 = Brake pedal

-Lines from controller to hydraulic modulator
 - - - - Lines from wheel-speed sensors to controller
 ——— Dual-circuit diagonal brake system

A11

Installation position of components
 BMW 7 series



A12

Installation position of components
 BMW 7 series



5. Bleeding of brake system

After replacing the hydraulic modulator, bleed brake system and perform high-pressure and low-pressure tests.

Take care when handling brake fluid!

- a) Only pour brake fluid into containers where there is no danger of accidental human consumption of the fluid (fatal dose 100 cm³).
- b) Even slight traces of mineral oil cause the brake system to fail. If the brake fluid is colorless or yellowish take particular attention since in this case the danger of a mix-up is at its greatest. If mineral oil is detected in the brake system or if there is a suspicion of same, the entire brake system must be thoroughly rinsed with brake fluid. The brake master cylinder must also be replaced.
- c) Do not allow brake fluid to come into contact with the vehicle paintwork as it contains components which dissolve paint.
- d) Brake fluid is highly hygroscopic, i.e. it absorbs humidity thus reducing the boiling point. Thus, brake fluid may only be stored in thoroughly sealed containers.

Note:

In the course of its service life the boiling point of the brake fluid drops due to the continuous absorption of humidity from the atmosphere. Thus, vapor bubbles may form in the brake system if the brakes are subjected to extremely heavy braking conditions. The brake fluid must therefore be replaced annually, preferably in the spring.



Bleeding

- When using a bleeding device for bleeding, pay attention to the manufacturer's operating instructions. In order to eliminate all air bubbles from the tandem brake master cylinder, the brake pedal must be completely depressed at least three times during the bleeding process with the bleeder screws open.
- If bleeding is performed by "pumping" with the brake pedal, close the appropriate bleeder screw each time before releasing the brake pedal to prevent air from being sucked in via the thread of the bleeder screw.
- Slowly release brake pedal to ensure that sufficient brake fluid is sucked in from the fluid reservoir during the return stroke of the plunger.
- The bleeding process is complete when clear, bubble-free brake fluid emerges via the bleeder hose.

Important!

The brake fluid pumped out during bleeding may not be reused since it may contain foreign matter which would then get back into the brake system.

- Fill fluid reservoir with brake fluid as far as "max" mark.



6. Checking the brake system for leaks

	<u>High-pressure test</u>	<u>Low-pressure test</u>
Line test pressure gauge pressure	50 bar	2-5 bar
Test duration	2 minutes	5 minutes
Pressure drop of set value	8% (max)	0 (constant)

Note

The leakage check, which must be performed in both brake circuits, comprises high-pressure and low-pressure testing.



6.1 High-pressure test

- Connect pressure tester to fixed calliper. To do this, unscrew bleeder screw and screw in fitting. Then bleed pressure tester.
- Allow engine to run at medium speed and generate as high a vacuum as possible by suddenly releasing the accelerator pedal.
- Using the brake-pedal actuating device depress the brake pedal until a line pressure of 50 bar gauge pressure is generated. Then secure brake pedal in this position.
- During the test period of 2 minutes, the pressure drop may not be greater than 8% of the set value. If the pressure drop is greater than this figure, the leak (brake master cylinder, brake hoses, brake lines, brake callipers) must be sought and eliminated, or the hydraulic modulator must be replaced.

6.2 Low-pressure test

- Release brake pedal actuating device until a line pressure of 2 ... 5 bar gauge pressure is indicated on the pressure gauge.
- During a test period of minutes the set pressure may not drop. If a drop in pressure is detected, the leak must be sought and eliminated, and the brake master cylinder or the hydraulic modulator must be replaced.



7. General notes on repair work and brake system

The ABS is basically maintenance-free, but when performing work on ABS-equipped vehicles, pay attention to the following:

1. If welding work is to be performed with an electric welding unit, the electronic controller plug must be removed.
2. During painting work the electronic controller may be subjected to a maximum of 95°C for brief periods and a maximum of 85°C for lengthy periods (approx. 2 hours).
3. After replacement of the hydraulic modulator, controller, wheel-speed sensors and wiring harness as well as work involving the ABS assemblies (e.g. work performed after accidents), the entire ABS system must be checked using the tester. Make absolutely sure that the brake lines are laid correctly.
4. After any work on the brake system, the brake system must be bled and high-pressure as well as low-pressure testing performed. All joints are to be checked for leaks.
5. If the battery has been removed, the cable clamps at the two terminals must be properly tightened after re-installation.
6. Do not use a fast charger for starting the engine.
7. Never disconnect the battery from the vehicle electrical system with the engine running.



8. Disconnect the battery from the vehicle electrical system when fast charging.
9. Make sure that all connectors of the wiring harness are securely connected.
10. Never connect or disconnect the wiring-harness plug of the controller with the ignition switched on.
11. For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced. Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced. No screws on the hydraulic modulator may be loosened. apart from the brake-line connections. After loosening it is no longer possible to get the brake circuits leak-tight! Danger!



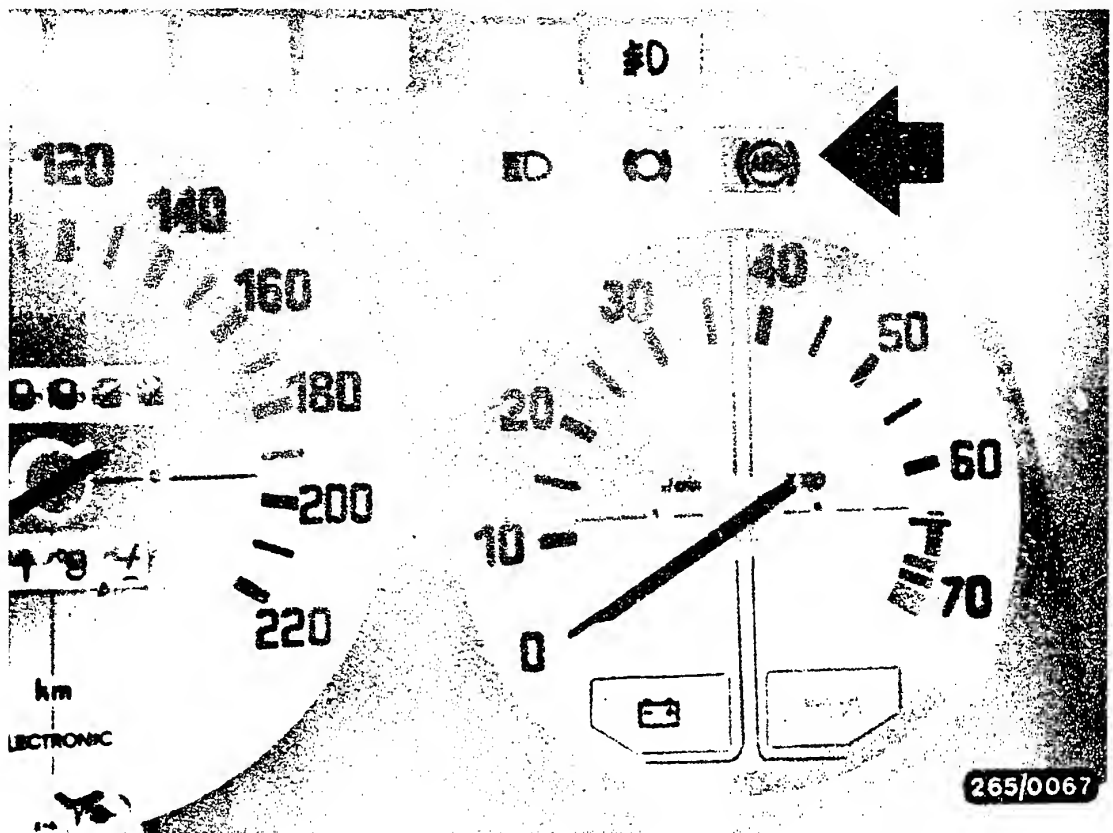
8. Operation and checking of ABS indicator lamp

Vehicles equipped with ABS come into the workshop with one of the following customer complaints:

- Indicator lamp not lighting up after switching on the ignition.
- Indicator lamp not going out after reaching a vehicle speed of above 6 km/h (previously) or after reaching idle speed (new).
- Indicator lamp lighting up again when driving or lighting up occasionally.

Confirm the complaint yourself before checking the entire ABS system with the ABS tester. For reasons of safety, the ABS may only be checked using the ABS tester. The ignition must always be off for connecting the ABS tester as well as when connecting or disconnecting the controller. If you have detected a fault with the ABS tester, always disconnect the controller before performing further trouble-shooting. In the following you are informed of the correct function and malfunction of the ABS indicator lamp.





Arrow = ABS indicator lamp in instrument panel

8.1 Previous indicator lamp function

When the ignition is switched on the indicator lamp lights up. When the vehicle reaches a speed of more than 6 km/h (with all 4 wheels), the lamp goes out. This process repeats itself every time the ignition is switched on and off.

If the ABS SYSTEM is defective the indicator lamp lights up continually and signals to the driver that the ABS is switched off.

The normal brakes still work.

New indicator lamp function

The indicator lamp lights up when the ignition is switched on and goes out as soon as the engine starts running. The controller receives the information "engine running" via terminal 61 of the alternator. As before, when the speed of the vehicle exceeds 6 km/h the ABS carries out a self-check.

If the ABS SYSTEM is defective the indicator lamp lights up at the latest when the speed of the vehicle exceeds 12 km/h (at 12 km/h the wheel-speed sensor voltages are checked).

Continuous lighting up of the indicator lamp advises the driver that the ABS is switched off.

The normal brakes still work.



Incorrect indicator-lamp indications are:

- Indicator lamp not lighting up after switching on the ignition.
- Indicator lamp not going out after reaching a vehicle speed of above 6 km/h (previously) or after reaching idle speed (new).
- Indicator lamp lighting up again when driving or lighting up occasionally.

The lighting up of the ABS indicator lamp advises the driver that the ABS is not in working order.

General note

Occasional lighting up of the indicator lamp may be caused by an insufficiently charged battery. The lamp only lights up as long as there is undervoltage, e.g. after switching on loads at idle.



9. ABS tester

General notes on how to use the tester

The tester checks functions of the controller, of the hydraulic modulator, of the wiring harness and also checks the components of the antiskid system (ABS).

The ABS tester measures actual values which are compared with the respective nominal values.

If the actual value indicated differs from the nominal value, carry out trouble-shooting as directed in the "trouble-shooting" column.

The tester should be connected between the controller and the ABS wiring harness (switch off the ignition when connecting the tester).

On the BMW (4-channel ABS) the different mechanical coding makes it necessary to use the adapter cable for the controller.

Do not drive the vehicle with the tester connected.

The respective test steps are set with the program-selector switch (1 to 2).

For the wheel-speed sensors and the hydraulic modulator depress the round buttons according to the test chart.

Test steps with a high power requirement are not triggered until after the illuminated key has been pressed.

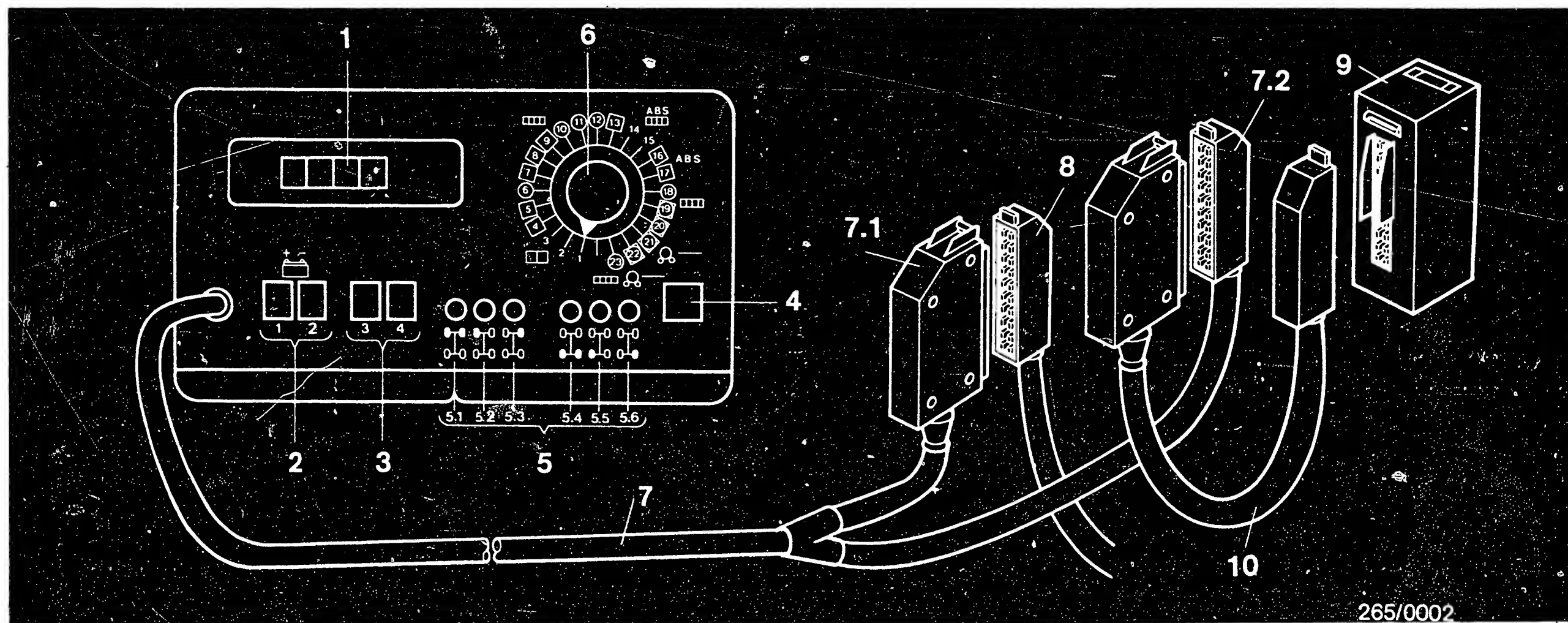
The illuminated key lights up automatically in the respective test steps.

The actual value is indicated either by the green-red lamps or by the digital display.

The test steps with the program-selector switch in positions 20...23 can only be performed on a dynamic brake analyzer.

The ABS tester must be converted for generation 2B.





265/0002

ABS tester

- 1 = Digital LED display unit
- 2 = Lamp 1 (green): battery voltage 0.K.
= Lamp 2 (red): battery voltage too low
- 3 = Lamp 3 (green): return-pump relay and valve relay as well as overvoltage protection 0.K.
Lamp 4 (red): return-pump relay and valve relay as well as overvoltage protection defective
- 4 = Illuminated key, yellow, for triggering individual test steps
- 5 = Channel selection key (wheel selection)
 - 5.1 = Front axle (FA)
 - 5.2 = Front left wheel (FL)
 - 5.3 = Front right wheel (FR)

- 5.4 = Rear axle (RA)
- 5.5 = Rear left wheel (RL)
- 5.6 = Rear right wheel (RR)
- 6 = Program-selector switch
- 7 = Connecting cable
- 7.1 = Connection to wiring harness
- 7.2 = Connection to adapter cable
- 8 = Multiple plug of vehicle-wiring harness
- 9 = ABS controller (installed in vehicle)
- 10 = Mechanically encoded adapter cable for 4-channel controller

B6

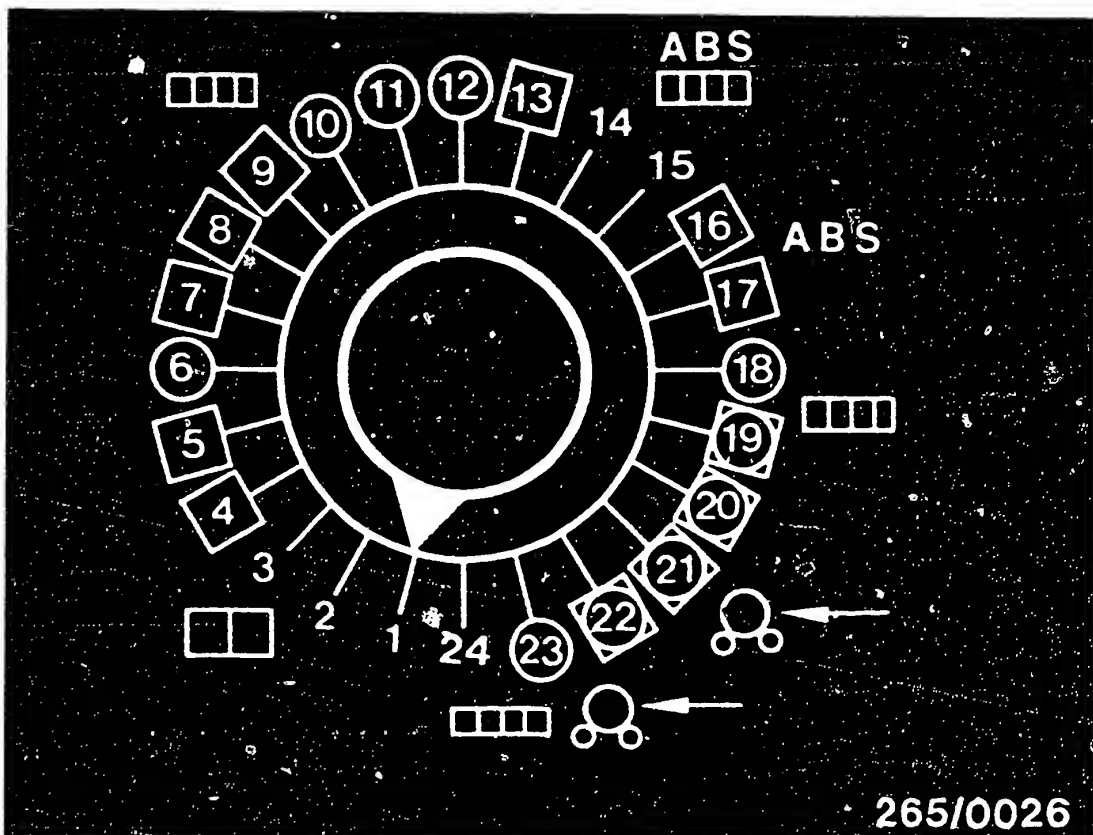
ABS tester
BMW 7 series



B7

ABS tester
BMW 7 series








Program-selector switch (description of symbols)


Program-selector switch for 24 program steps

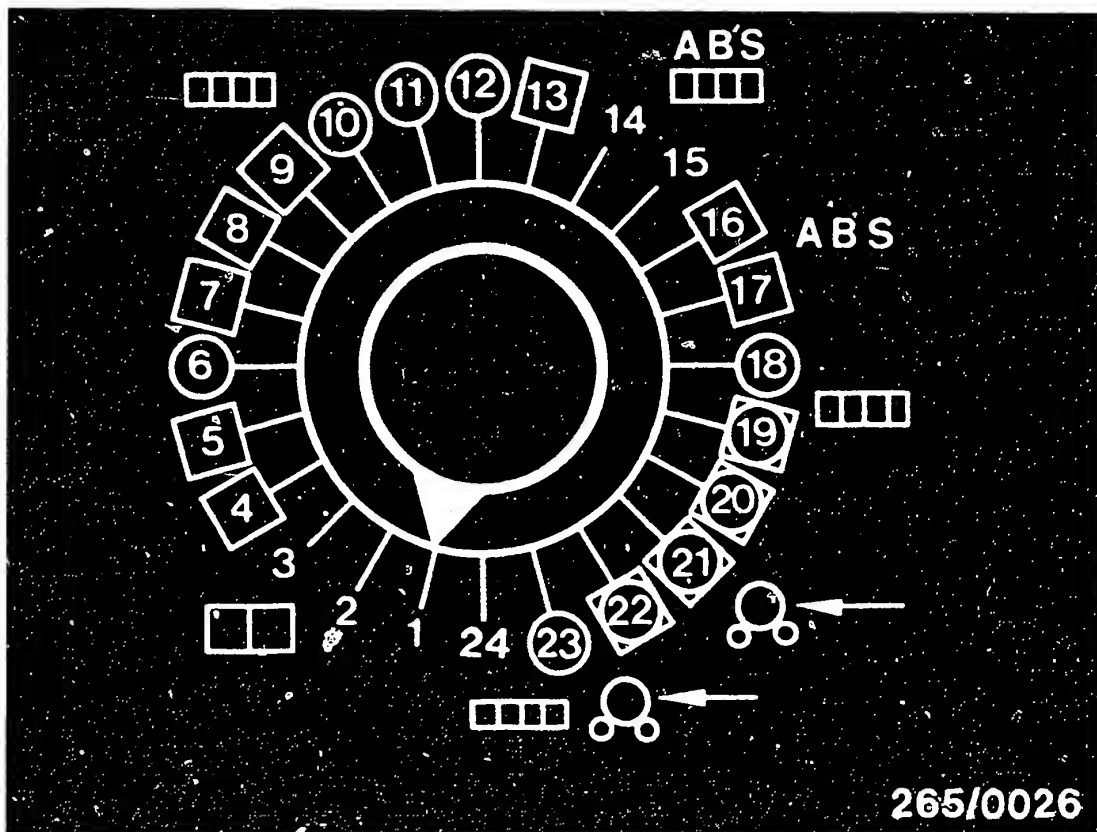
Symbols for additional operations:

Program step with  : press illuminated key (Item 4)

Program step with  : press respective channel selection keys (Items 5.1 to 5.6)

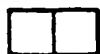
Program step with  : press channel selection key (Items 5.1 to 5.6), press illuminated key (Item 4)

Program step with  : first drive front axle and then rear axle of vehicle onto dynamic brake analyzer.



Program-selector switch (description of symbols)
(continued)

Display:



Red-green display, lamp units
(Item 2 or Item 3)

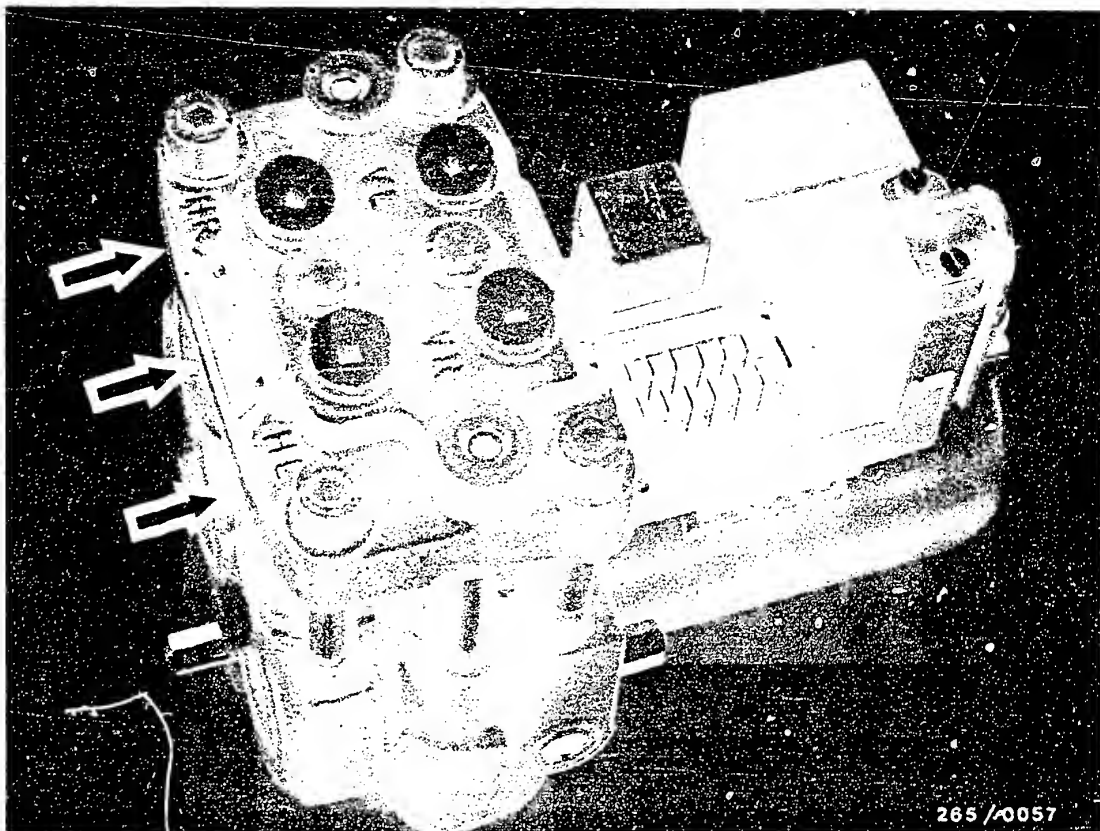


Digital display unit (Item 1)

ABS :

Watch indicator lamp in vehicle.





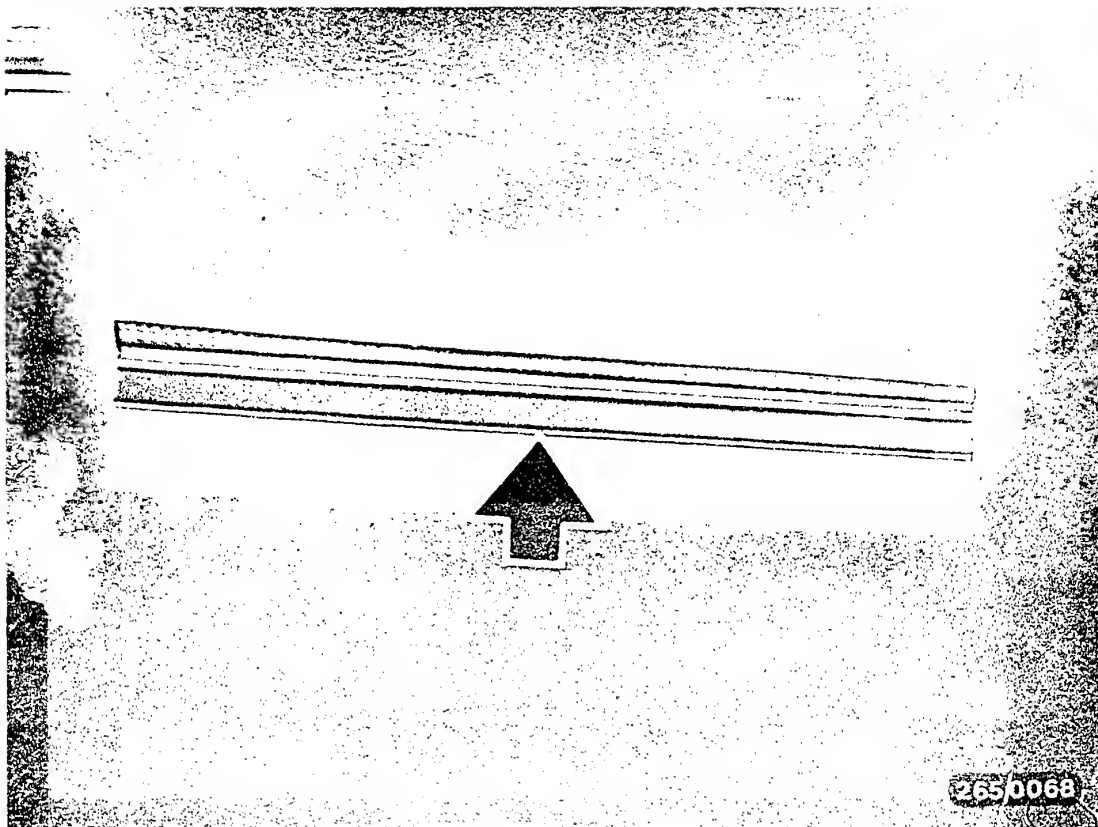
10. Test conditions for testing with ABS tester

- Check the ground connection of the return pump for security.
- Check the hydraulic connections on the hydraulic modulator for leaks (visual examination). Pay particular attention to joints (arrows).



- If the ABS indicator lamp lights up occasionally when driving (e.g. after switching on loads) and goes out again automatically, check the battery and the power supply (generator, regulator and voltage drops).
- If the ABS indicator lamp lights up constantly and does not go out, check the following points:
 - Is the multiple plug correctly fitted to the controller and has it locked in position?
Are all plug contacts OK? Have the spring contacts locked in position?
 - Has the V-belt broken? (generator not providing any power, charge indicator lamp and ABS indicator lamp light up).
 - Is there voltage at generator terminal 61?
Plug connector and cable to ABS controller OK?
 - Pay particular attention to testing for loose contacts on wheel-speed sensors with program-selector switch in position 10.





Arrow = Glove compartment cover with rail

- Connect the ABS tester to controller and ABS wiring harness using adapter cable.

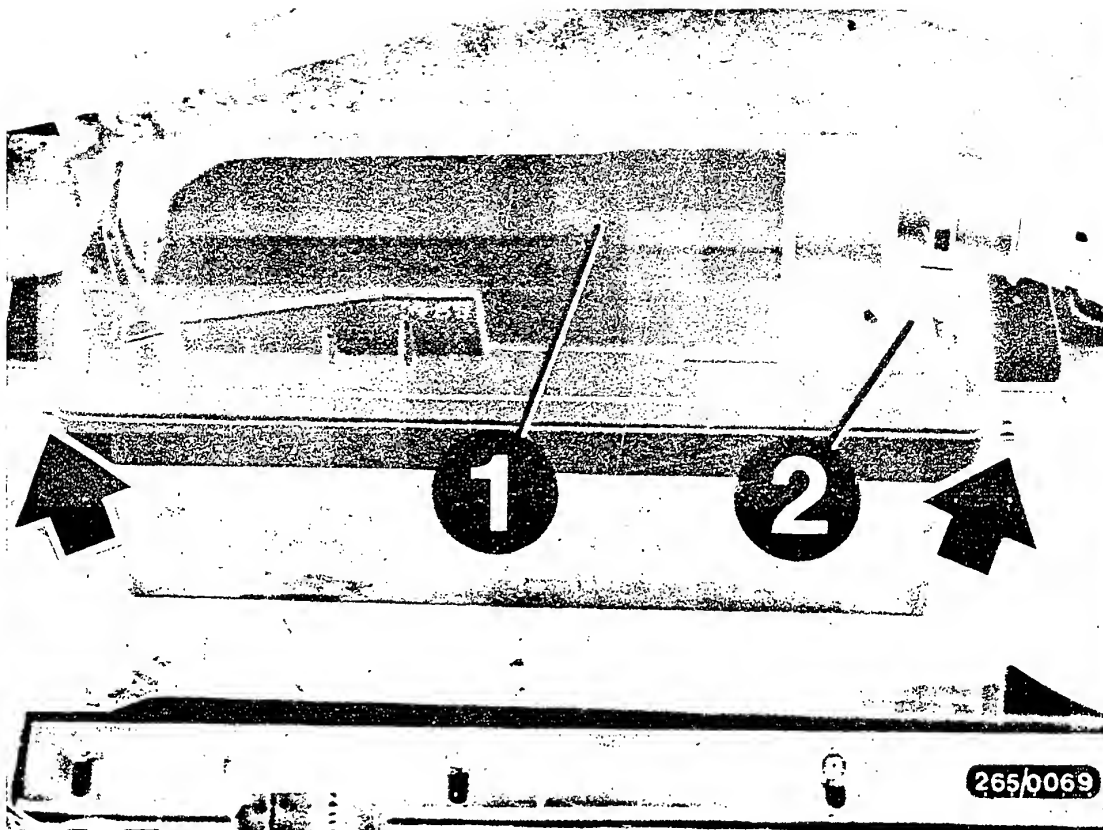
Caution! Connect and disconnect the controller only with the ignition switched off.

Connection of ABS tester

The installation position of the controller is in the glove compartment behind a cover.

To remove, pull down glove compartment cover with rail.





1 = Multiple plug
2 = Detent

Switch off ignition before disconnecting multiple plug (2).

Push back spring (1), hinge up multiple plug (2) and unhook from encoding block.

Unscrew controller (arrows).

B13

Test conditions
BMW 7 series



- For testing with the tester, switch on the ignition in all program-selector switch positions (tester operates on power supply from vehicle battery).
- Watch tester lamps 1 and 2 in all program-selector switch positions.

Caution!

Do not drive the vehicle with the tester connected.

Repeat the entire test program after any repairs.

General note on trouble-shooting

Check all cables for short circuit to ground and for contact with positive cables, and watch for any indications of wear, abrasion and pinching.



11. Testing with the ABS tester

Note on test steps 1...48

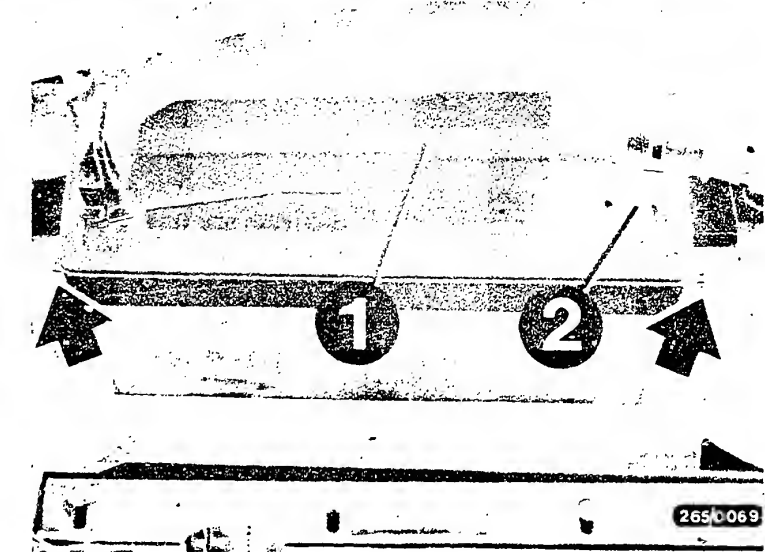
In the following test steps a broad, white surrounding frame in the "Operation" column indicates which operation has to be changed compared with the preceding test step.

B 15

Test with ABS tester
BMW 7 series

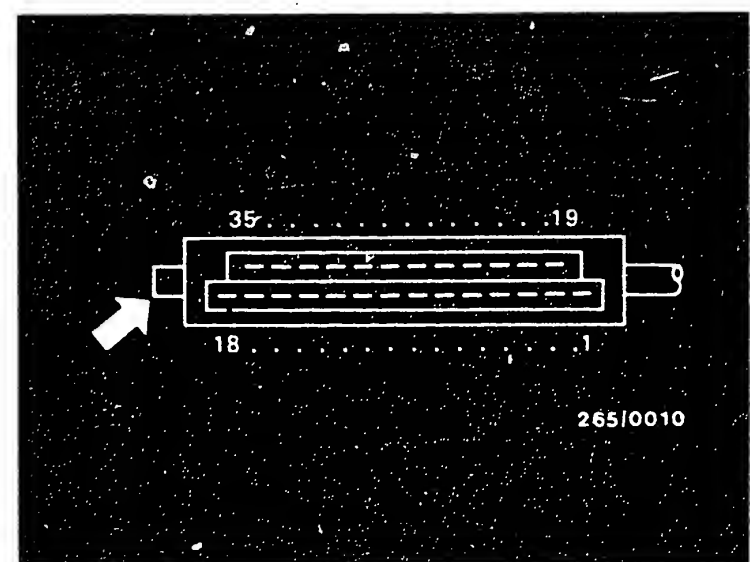


TEST STEP 1 Note: This test step is important for all the following test steps, i.e. watch lamps 1 and 2 throughout the entire test procedure. For generation 2B the tester must be converted.			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	1 to 24	Lamp 1 (green) must light up	Component: Power supply
<u>Operation in vehicle:</u>		<u>Note:</u>	<u>Operation:</u>
Switch on ignition		Lamp 1 (green) = OK.	Monitoring of power supply in all program-selector switch positions.
		Lamp 2 (red) = fault. Watch for occasional lighting up. If reading OK, continue testing with <u>next test step</u> .	<u>Malfunction:</u> 1. No reading 2. Green lamp goes out and red lamp lights up, possibly only briefly as long as there is undervoltage.



1 = Multiple plug
 2 = Detent

Top view of multiple plug K1 (35-pin) with terminal numbers
 Arrow = Lug with mechanical coding



Trouble-shooting (switch off ignition):

1. No reading:

- Multiple plug not correctly attached.

Check the following cables:

- Positive cable from driving switch term.15 to multiple plug term.1
- Negative cable from multiple plug term.10 to ABS ground
- ABS ground terminal must be bare down to the metal and must not have any contact resistance.

Continued on B18/B19

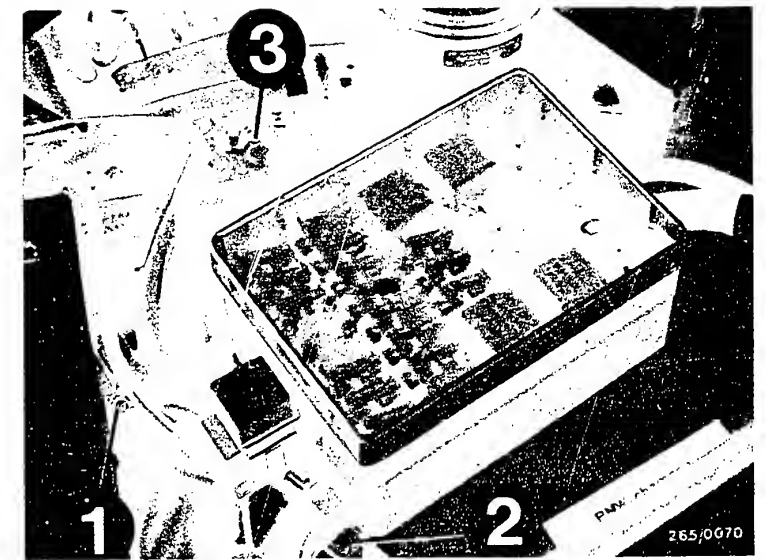
Trouble-shooting for TEST STEP 1 (continued)

Lamp 2 (red) lights up or lights up occasionally while testing:
Stop testing and eliminate the cause of the trouble.

Causes of the trouble:

1. Battery insufficiently charged. Charge battery or allow engine to run.
2. High voltage drops across ABS ground terminal.
Ground terminal must be bare down to the metal.

After eliminating the fault, perform the complete test program.



- 1 = Ground terminal for pump motor
- 2 = ABS ground terminal on wheel box under fuse box
- 3 = Hydraulic modulator

B 18

Test with ABS tester
BMW 7 series

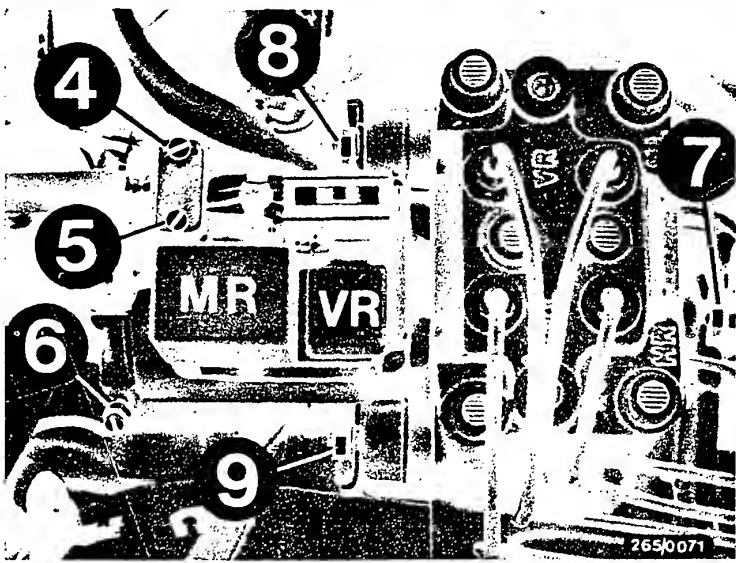


B 19

Test with ABS tester
BMW 7 series



TEST STEP 2			
Operation:		Reading:	Testing:
Program-selector switch position	1	Lamp 3 (green) must light up	<u>Component:</u> Valve relay
<u>Operation in vehicle:</u> Switch on ignition		If reading OK, continue testing with next test step.	<u>Operation:</u> Off-position
			<u>Malfunction:</u> Lamp 4 (red) lights up



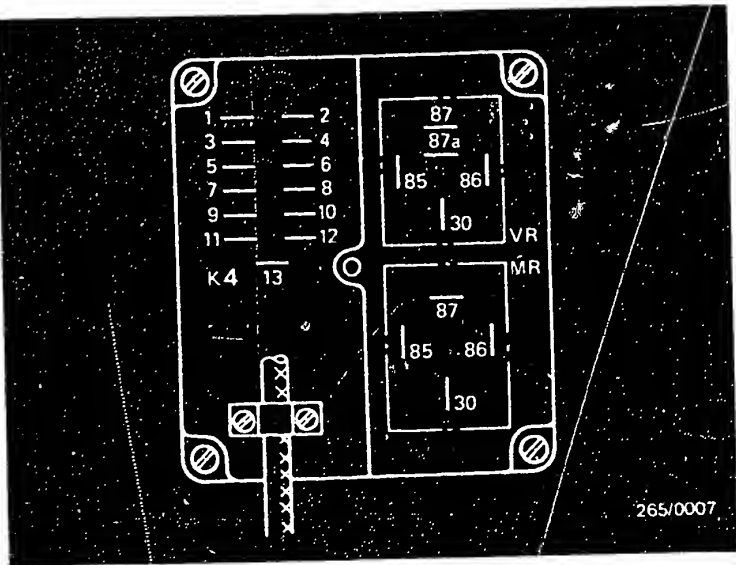
MR = Return-pump relay
VR = Valve relay

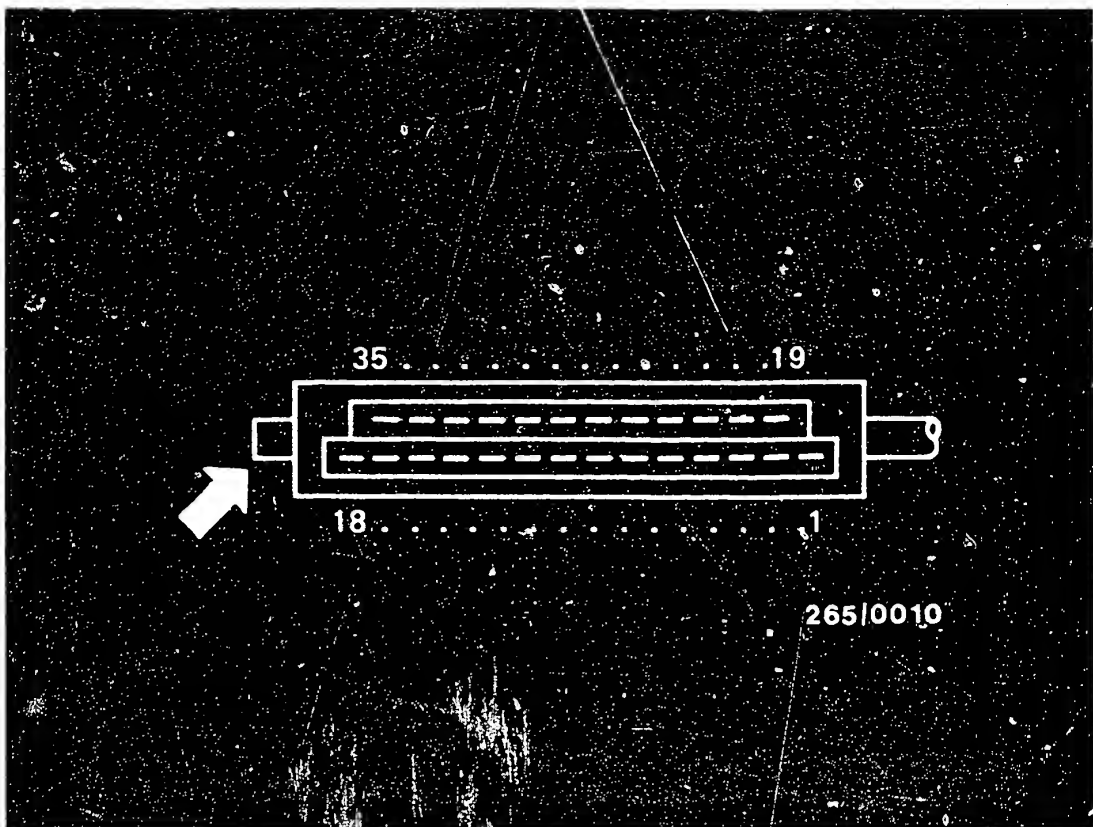
Top view of plug-in plate on hydraulic modulator
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Trouble-shooting (switch off ignition):

- Valve relay defective.
Caution! Use only relay with correct electrical terminal assignment.
- Ground connection has high contact resistance or open circuit.
- Test the following cables for continuity:
 - From ground to plug K 3/term.8
 - From K4/term.8 to valve relay term.87 a
 - From K4/term.12 to valve-relay plug term.30
 - From K3/term.12 to multiple plug K1/term.32

Continued on B22



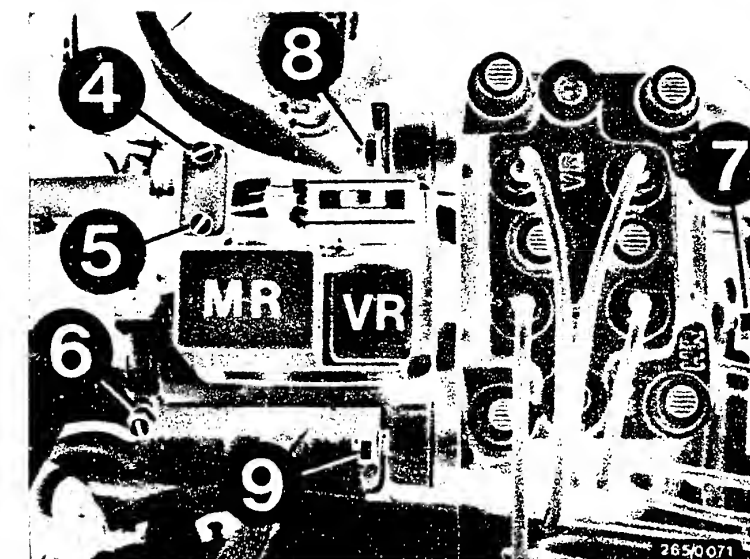


Trouble-shooting for TEST STEP 2 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding.

TEST STEP 3			
Operation:		Reading:	Testing:
Program selector switch position	2	Lamp 3 (green) must light up	<u>Component:</u> Valve relay
<u>Operation in vehicle:</u> Switch on ignition.		If reading OK, continue testing with next test step.	<u>Operation:</u> Relay make contact.
			<u>Malfunction:</u> Lamp 4 (red) lights up



MR = Return pump relay
VR = Valve relay

Top view of plug-in plate on hydraulic modulator
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Trouble-shooting (switch off ignition):

- Valve relay defective.
Caution! Use only relay with correct electrical terminal assignment.
- Test the following cables for continuity:
 - From term.B+ to plug K3/term.4
 - From K4/term.4 to valve relay term.87
 - From K3/term.6 to multiple plug K1/term.27
 - From K4/term.6 to valve relay term.85
 - From valve relay term.86 to return-pump relay term.86
 - From return-pump relay term.86 to K4/term.2
 - From K3/term.2 to driving switch term.15.

Continued on C3

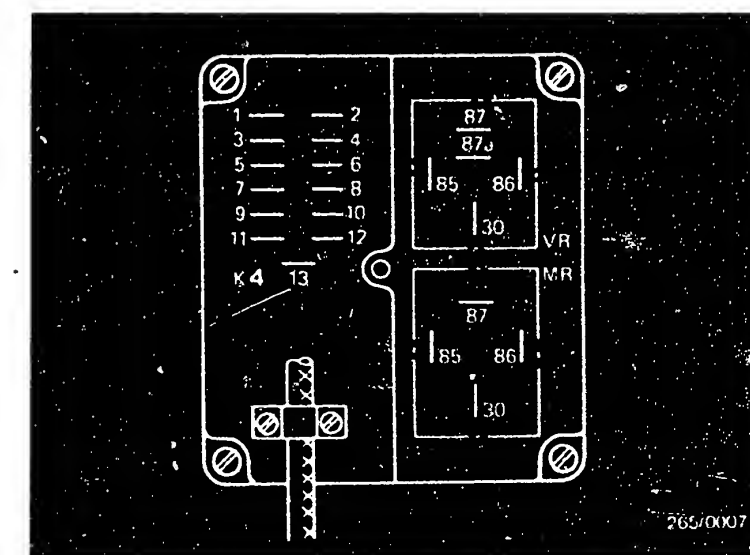
C1

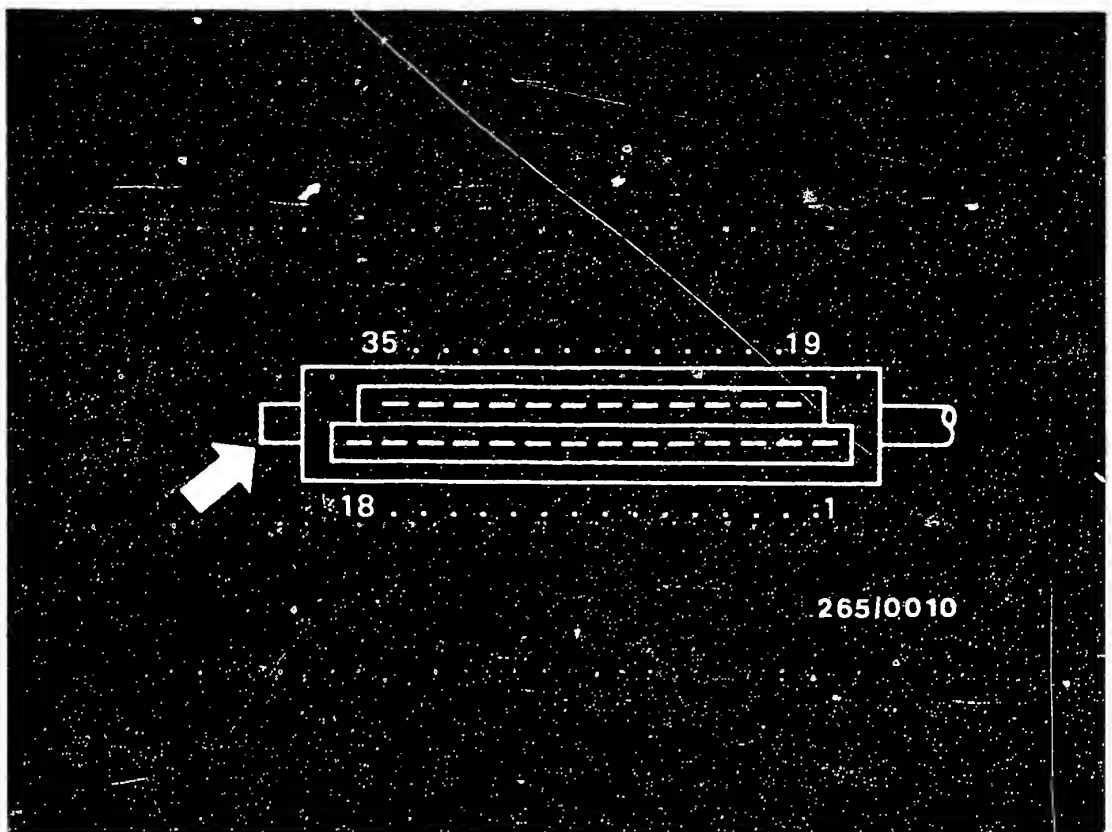
Test with ABS tester
BMW 7 series



C2

Test with ABS tester
BMW 7 series



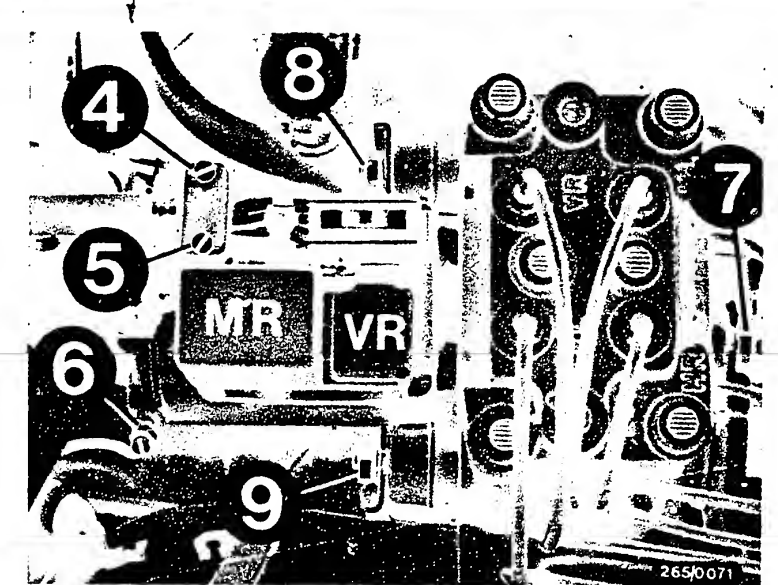


Trouble-shooting for TEST STEP 3 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding

TEST STEP 4			
Operation:		Reading:	Testing:
Program-selector switch position	3	Lamp 3 (green) must light up.	<u>Component:</u> Return-pump relay
<u>Operation in vehicle:</u> Switch on ignition.		If reading OK, continue testing with next test step.	<u>Operation:</u> Off-position
			<u>Malfunction:</u> Lamp 4 (red) lights up



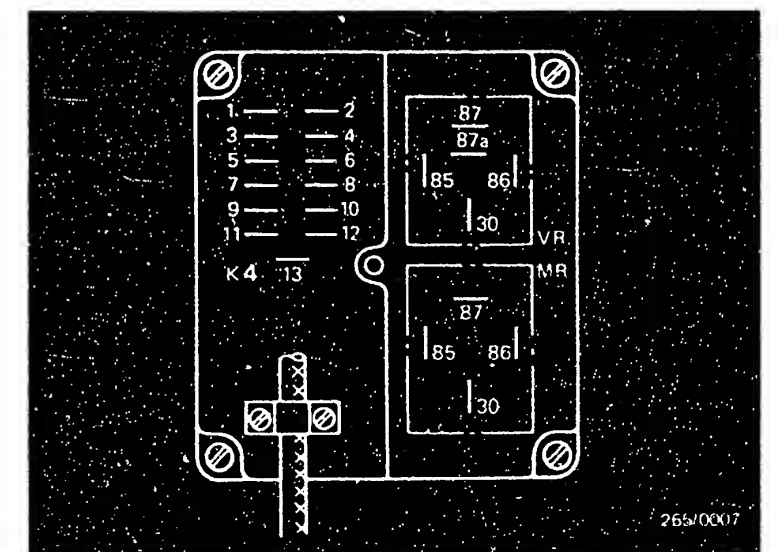
MR = Return pump relay
VR = Valve relay

Top view of plug-in plate on hydraulic modulator
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Trouble-shooting (switch off ignition):

- Return-pump relay defective.
- Check ground terminals of pump motor for security and contact resistance.
- Test the following cables for continuity:
From multiple plug K1/term.14 to plug K3/term.9
From K4/term.9 to return-pump relay term.30 and to positive terminal of pump motor.
- Check positive terminal of pump motor for security.
Check pump motor for continuity. If no continuity can be measured, continue testing with test step 5.

Continued on C6



C4

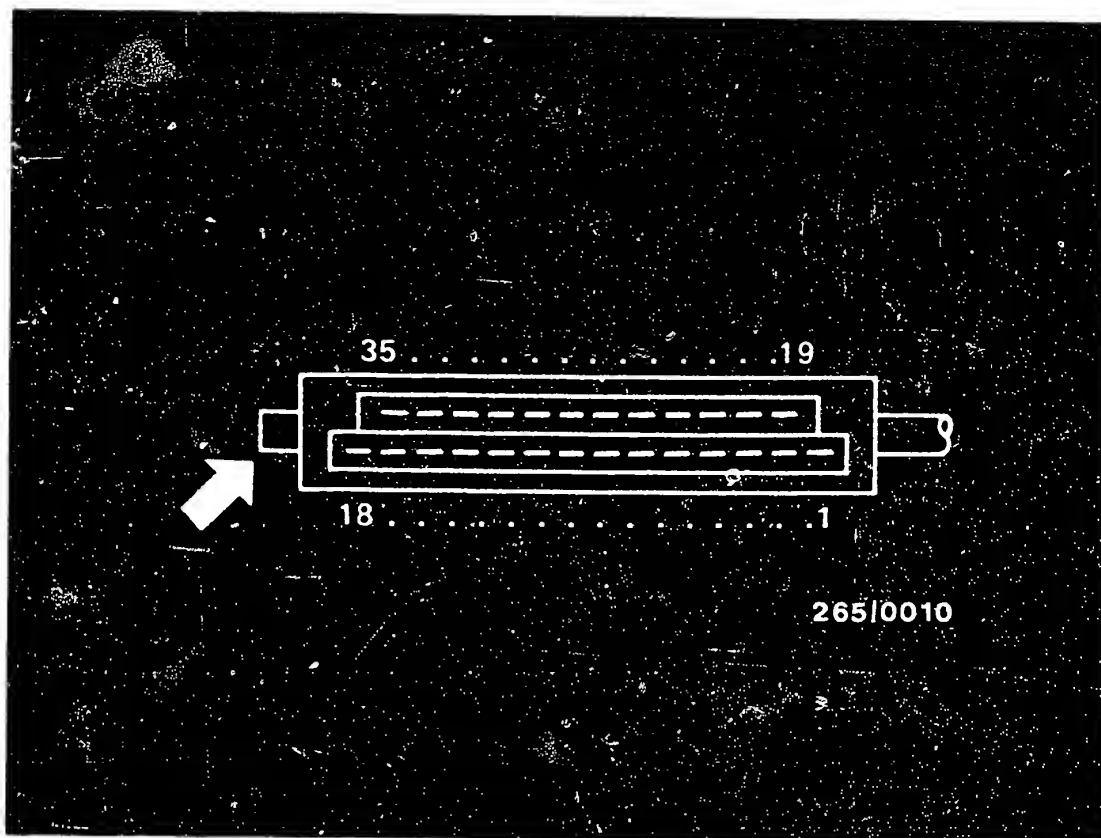
Test with ABS tester
BMW 7 series



C5

Test with ABS tester
BMW 7 series



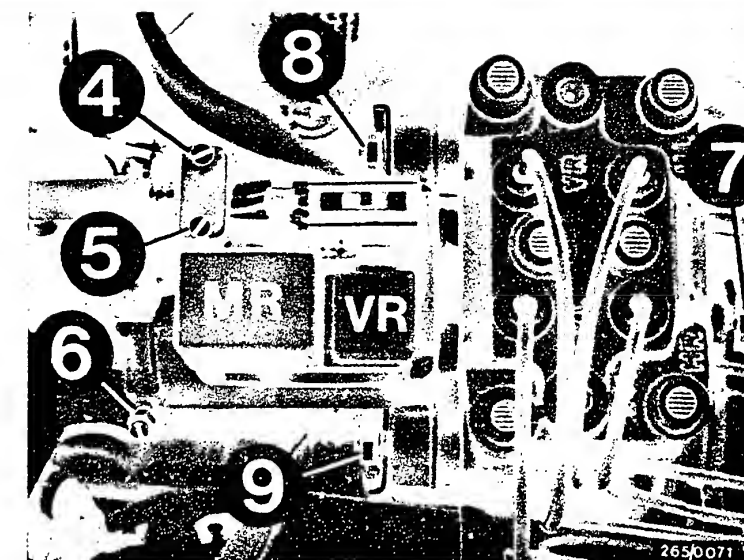


Trouble-shooting for TEST STEP 4 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding

TEST STEP 5			
Operation:		Reading:	Testing:
Program-selector switch position	4	Lamp 3 (green) must light up Pump motor can be heard to operate.	Component: Return-pump relay
Illuminated key lights up press key	●		Operation: Relay make contact
Operation in vehicle: Switch on ignition		If reading OK, continue testing with next test step.	Malfunction: Lamp 4 (red) lights up



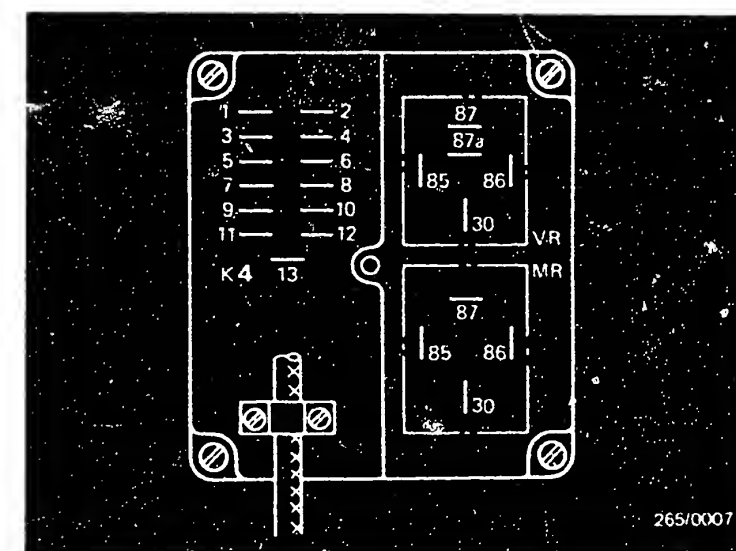
MR = Return pump relay
VR = Valve relay

Top view of plug-in plate on hydraulic modulator
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Trouble-shooting (switch off ignition):

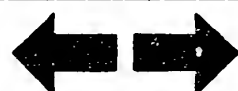
- Return-pump relay defective.
- Test the following cables for continuity:
From multiple plug term.85 to K4/term.11
From K3/term.11 to multiple plug K1/term.28
From return-pump relay term.87 to K4/term.13
From K3/term.13 to term.B+
- Pump motor not operating:
Continue testing with test step 6.

Continued on C9



C7

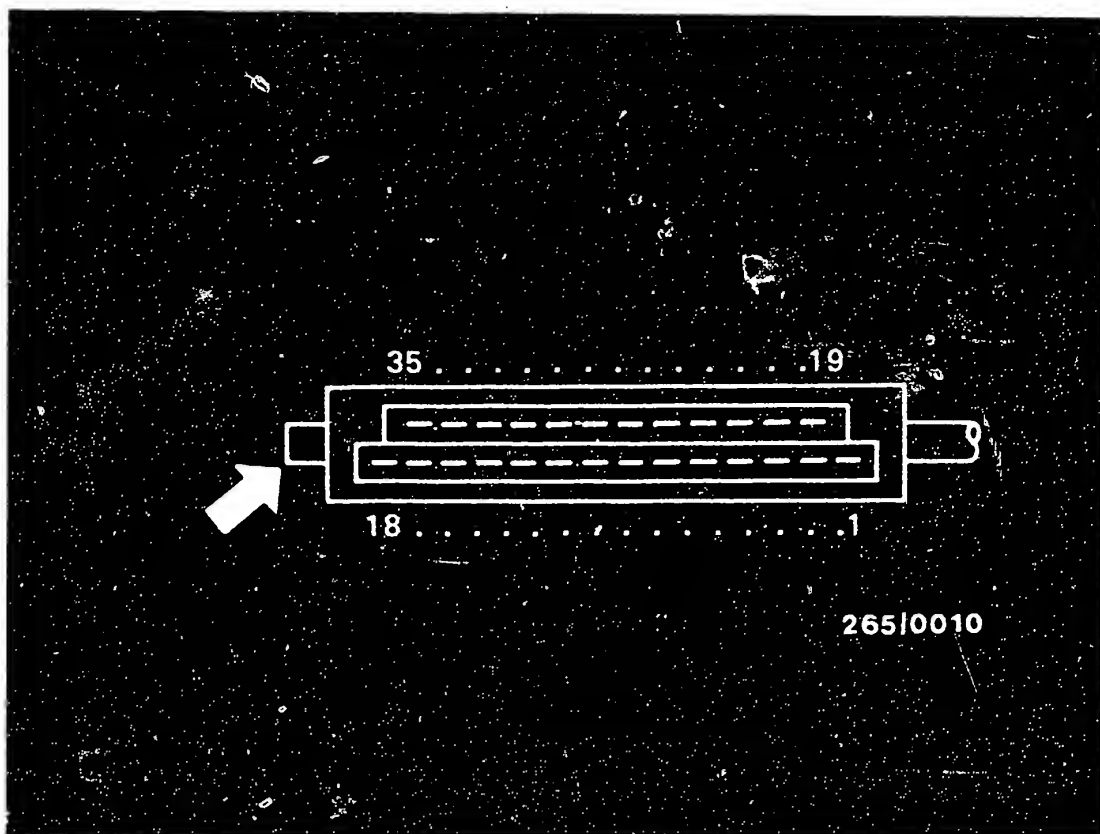
Test with ABS tester
BMW 7 series



C8

Test with ABS tester
BMW 7 series





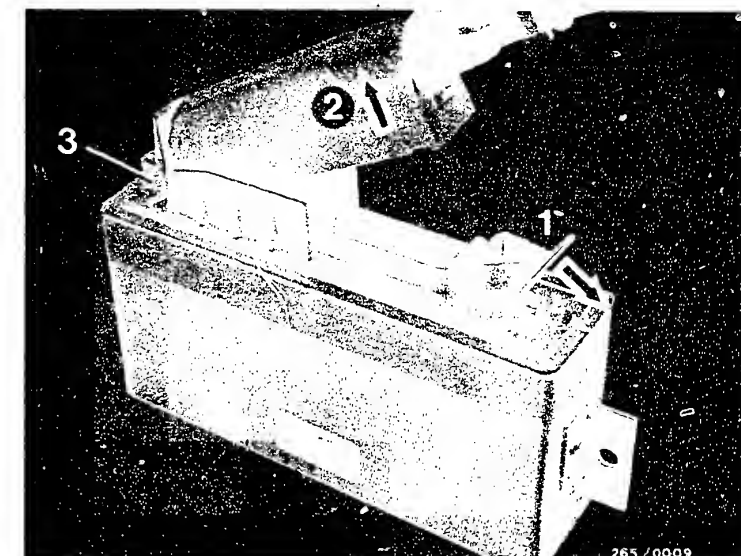
Trouble-shooting for TEST STEP 5 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding.

TEST STEP 6 Note: Disconnect overvoltage protection device from tester (back).

<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	5	Lamp 3 (green) must light up.	<u>Component:</u> Controller
Illuminated key lights up, press key	●		<u>Operation:</u> Overvoltage protection
<u>Operation in vehicle:</u> Switch on ignition		If reading OK, continue testing with <u>next test step.</u>	<u>Malfunction:</u> Lamp 4 (red) lights up



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

Trouble-shooting:

1. Repeat test step.
2. Replace controller (switching off ignition beforehand).

Notes:

- Switch off ignition before disconnecting multiple plug
- To disconnect multiple plug, push back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, ensure that multiple plug locks into spring.

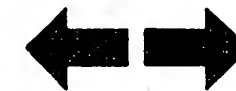
C10

Test with ABS tester
BMW 7 series

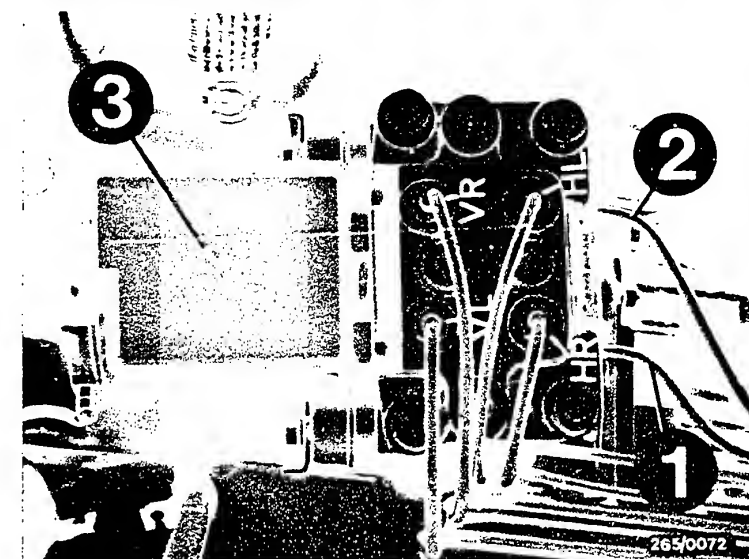


C11

Test with ABS tester
BMW 7 series

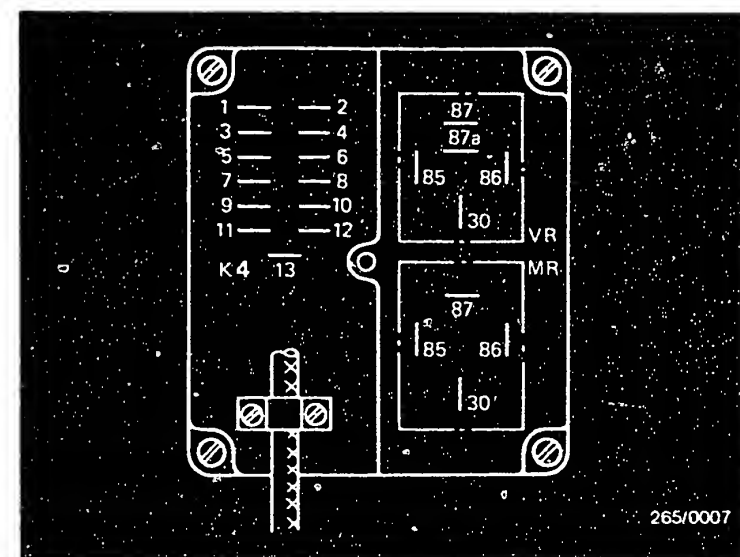


TEST STEP 7			
Operation:		Reading:	Testing:
Program-selector switch position	6	Read off digital display unit each time after pressing a key.	Component: Hydraulic modulator
1. Press key FL	●	<u>0.7...1.7 Ω</u>	Operation: Valve internal resistance FL
2. Press key FR	●	<u>0.7...1.7 Ω</u>	Valve internal resistance FR
3. Press key RL	●	<u>0.7...1.7 Ω</u>	Valve internal resistance RL
4. Press key RR	●	<u>0.7...1.7 Ω</u>	Valve internal resistance RR
Operation in vehicle: Switch on ignition.		If reading OK, continue testing with next test step.	Malfunction: Internal resistance less than 0.7 Ω or greater than 1.7 Ω



- 1 = Brake line to front brake master cylinder
2 = Brake line to rear brake master cylinder
3 = Screw for lid

Top view of plug-in plate on hydraulic modulator
Position of terminals
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug



Trouble-shooting (switch off ignition):

1. Measure internal resistance directly at hydraulic modulator:

Valve FL	between K4/term.1 and K4/term.12
Valve FR	between K4/term.3 and K4/term.12
Valve RL	between K4/term.5 and K4/term.12
Valve RR	between K4/term.7 and K4/term.12

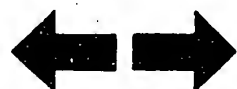
Nominal value not reached:

Replace hydraulic modulator.

Continued on C17/C18

C12

Test with ABS tester
BMW 7 series



C13

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 7 (continued)

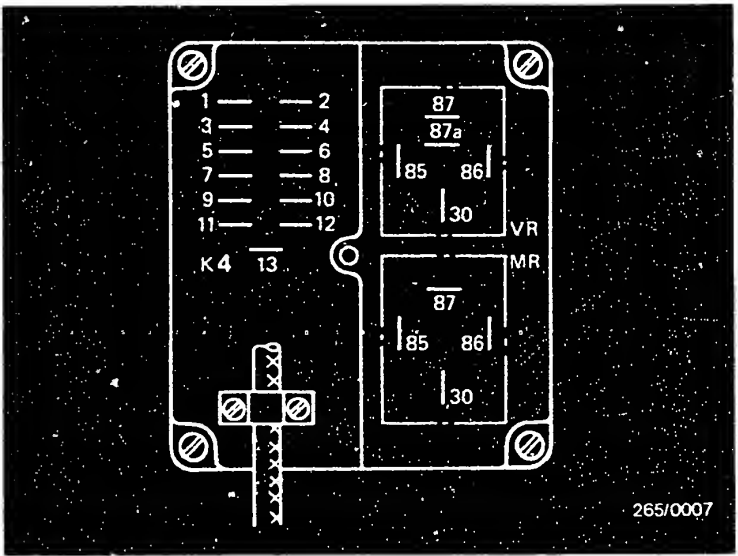
2. Test cables for continuity (set value 0 Ω):

Valve FL	between K3/term.1 and multiple plug K1/term.2
Valve FR	between K3/term.3 and multiple plug K1/term.35
Valve RL	between K3/term.5 and multiple plug K1/term.18
Valve RR	between K3/term.7 and multiple plug K1/term.19

If open circuit:

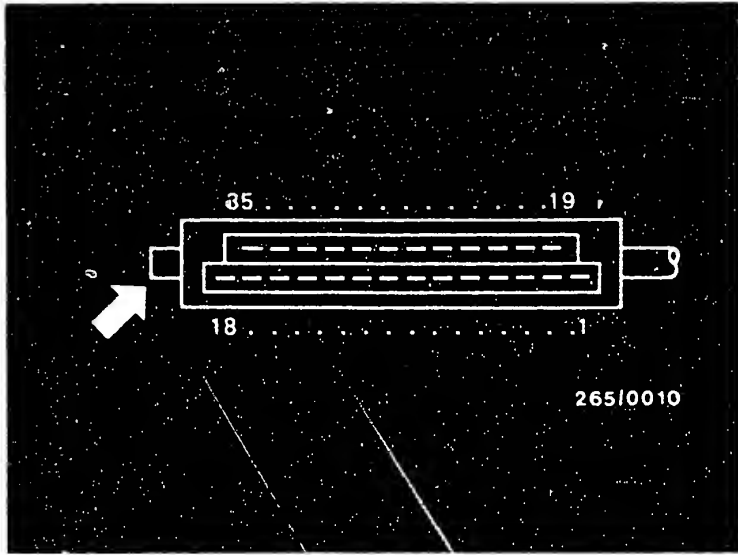
- Check plug-in connections
- Eliminate open circuit

Continued on C 16



Top view of plug-in plate on hydraulic modulator
Position of terminals
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

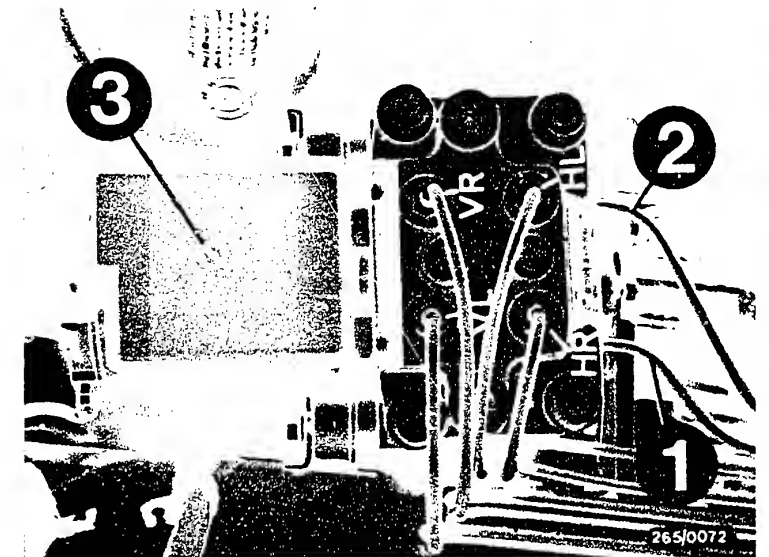


Trouble-shooting for TEST STEP 7 (continued)

Removing the hydraulic modulator

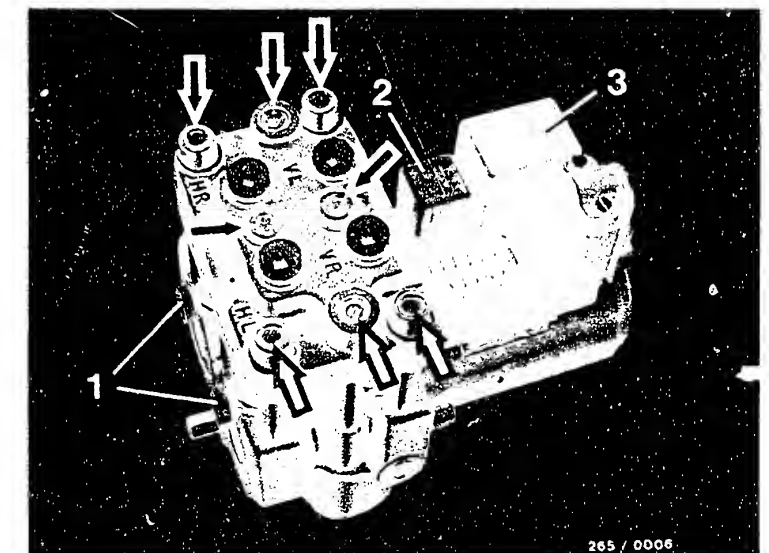
- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake-line connections, it is not permissible to loosen any screws on the hydraulic modulator. In particular the hexagon-socket-head cap screws (bottom picture - arrows) may under no circumstances be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12...16 Nm) or replace, or replace the hydraulic modulator.

Continued on C18/C19



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay



C16

Test with ABS tester
BMW 7 series



C17

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 7 (continued)

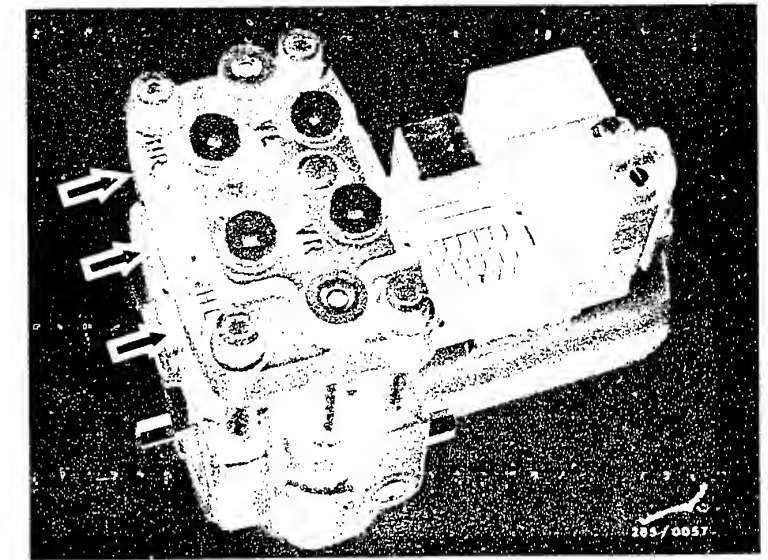
Pay particular attention to the joint identified by 3 arrows (top picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid is possible at this point.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. FL of hydraulic modulator must be connected to the front left wheel brake cylinder).
- Markings on hydraulic modulator

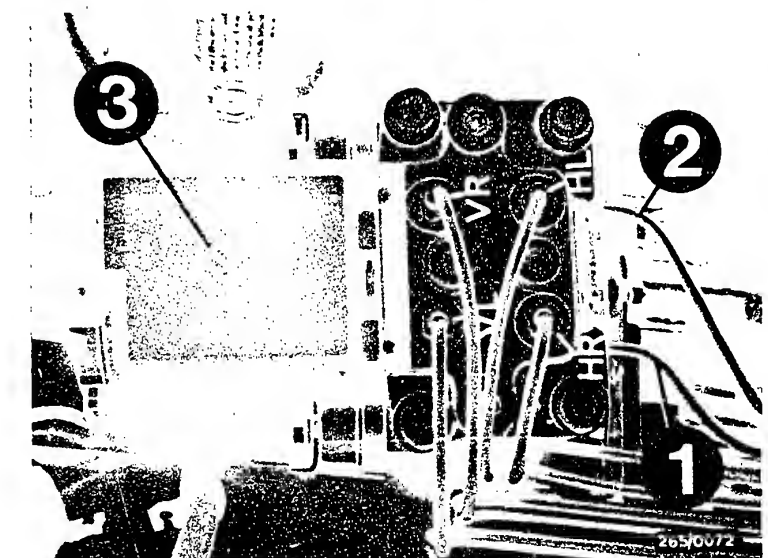
VL = Connection for brake line front left (wheel brake cylinder)
VR = Connection for brake line front right (wheel brake cylinder)
HR = Connection for brake line rear right (wheel brake cylinder)
HL = Connection for brake line rear left (wheel brake cylinder)

Continued on C20/C21



Arrows = Joint

- 1 = Brake line to front brake master cylinder
2 = Brake line to rear brake master cylinder
3 = Screw for lid



C18

Test with ABS tester
BMW 7 series



C19

Test with ABS tester
BMW 7 series

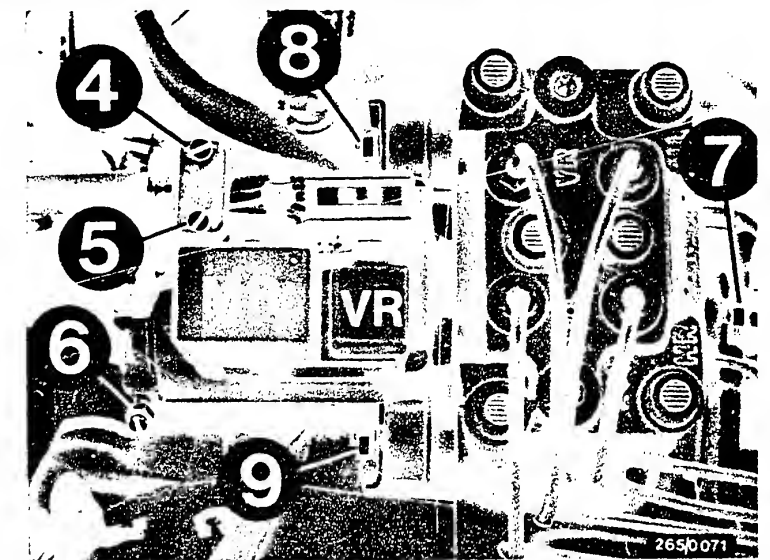


Trouble-shooting for TEST STEP 7 (continued)

- Use only the specified double-end flare nut wrench 9x11 mm for loosening and tightening the brake lines.
- Mark brake lines and remove from hydraulic modulator.
- Catch the brake fluid and do not bring it into contact with your skin or clothing or with paintwork.
- Immediately seal the brake lines and connections with dummy plugs.
- Disconnect ground cable (6) from pump motor.
- Loosen fastening screw and remove cover.
- Loosen bracket (4, 5) and remove plug.
- Loosen hexagon nuts from holder (7,8,9) and remove hydraulic modulator.

Installation

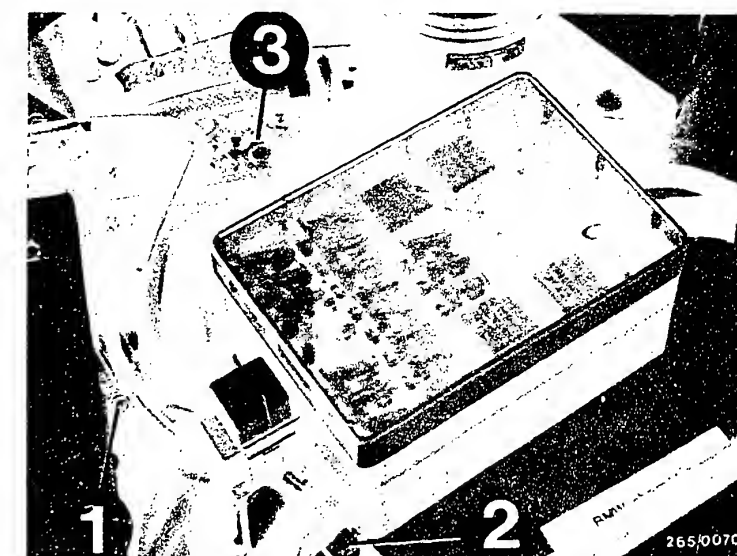
- Mount hydraulic modulator in the holder and fasten with the hexagon nuts.
- Connect ground cable to pump motor. Plug on 13-pin plug and fasten with the bracket (4,5).
- Fasten cover on the hydraulic modulator with the screw.
- Connect the brake lines to the hydraulic modulator in accordance with the markings.
- Observe the tightening torque for the brake-line connections on the hydraulic modulator: 12...16 Nm.
- Bleed the brake system and check for leaks.
- Fully test the ABS with the tester.



4 and 5 = Screws for wiring harness strain relief
6 = Ground terminal for pump motor
7,8 and 9 = Fastening points for hydraulic modulator
MR = Return-pump relay
VR = Valve relay



TEST STEP 8			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	7	Digital display unit must indicate <u>80...300 mV.</u>	<u>Component:</u> Ground connection term.10
Illuminated key lights up, press key	●	If reading OK, continue testing with <u>next test step.</u>	<u>Operation:</u> Contact resistance
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading less than 80 mV or greater than 300 mV



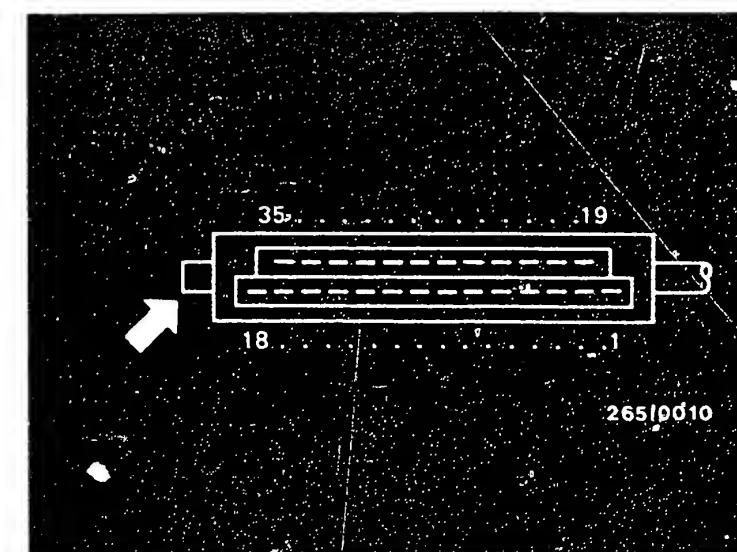
- 1 = Ground terminal for pump motor
2 = ABS ground terminal
3 = Hydraulic modulator

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

Trouble-shooting: (switch off ignition):

1. Reading less than 80 mV: Have the tester checked.
2. Reading greater than 300 mV: Check ground terminal (under fuse box on wheel box) for high contact resistance. Ground terminal must be bare down to the metal and must be securely tightened.

Test cables (10) for open circuit:
From ground to multiple plug K1/term.10.



C22

Test with ABS tester
BMW 7 series

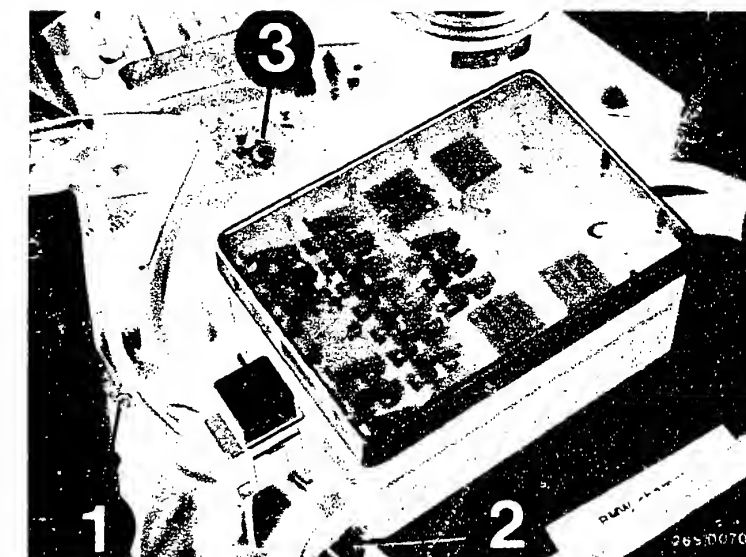


C23

Test with ABS tester
BMW 7 series

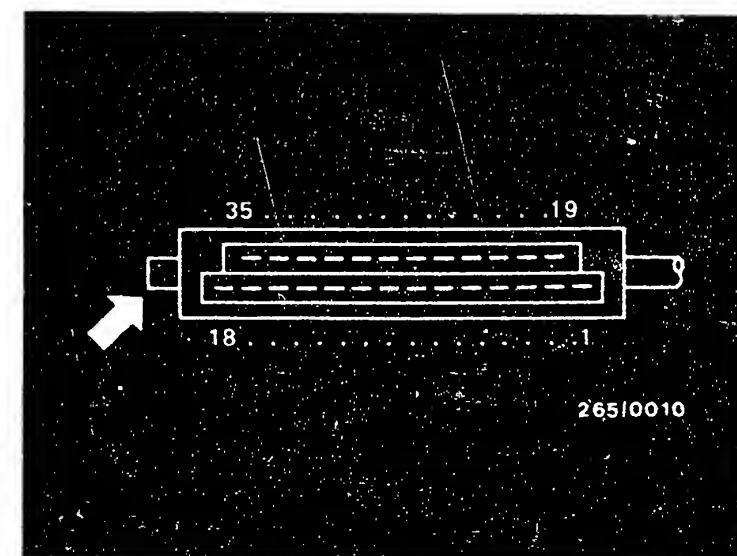


TEST STEP 9			
Operation:		Reading:	Testing:
Program-selector switch position	8	Digital display unit must indicate <u>30...250 mV.</u>	<u>Component:</u> Ground connection term.34
Illuminated key lights up, press key	●		<u>Operation:</u> Contact resistance
<u>Operation in vehicle:</u> Switch on ignition		If reading OK, continue testing with next test step.	<u>Malfunction:</u> Reading less than 30 mV or greater than 250 mV



- 1 = Ground terminal for pump motor
2 = ABS ground terminal
3 = Hydraulic modulator

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding



Trouble-shooting (switch off ignition):

1. Reading less than 30 mV: Have the tester checked.
2. Reading greater than 250 mV: Test ground terminal (under fuse box on wheel box) for high contact resistance and open circuit. Ground terminal must be bare down to the metal and must be securely tightened.

Test cable (34) for open circuit:
From ground to multiple plug K1/term.34

D1

Test with ABS tester
BMW 7 series

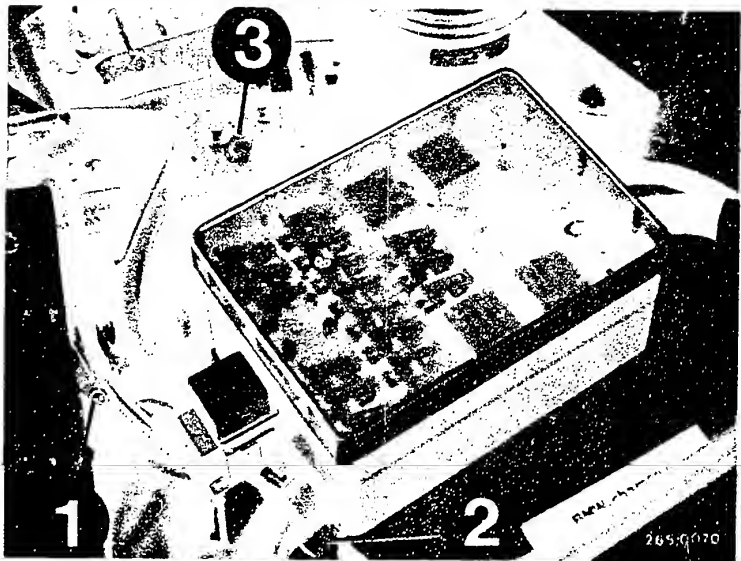


D2

Test with ABS tester
BMW 7 series



TEST STEP 10			
Operation:		Reading:	Testing:
Program-selector switch position	9	Digital display unit must indicate <u>30...250 mV.</u>	Component: Ground connection term. 20
Illuminated key lights up, press key	●		Operation: Contact resistance
Operation in vehicle: Switch on ignition		If reading OK, continue testing with next test step.	Malfunction: Reading less than 30 mV or greater than 250 mV



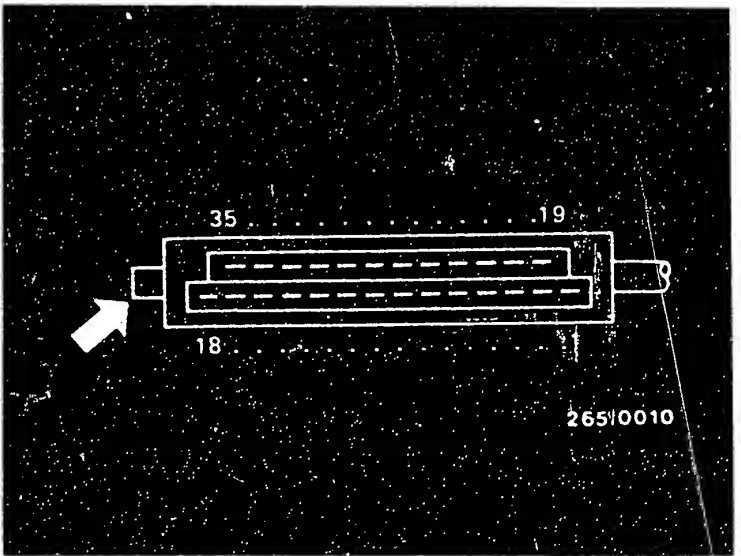
1 = Ground terminal for pump motor
2 = ABS ground terminal
3 = Hydraulic modulator

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

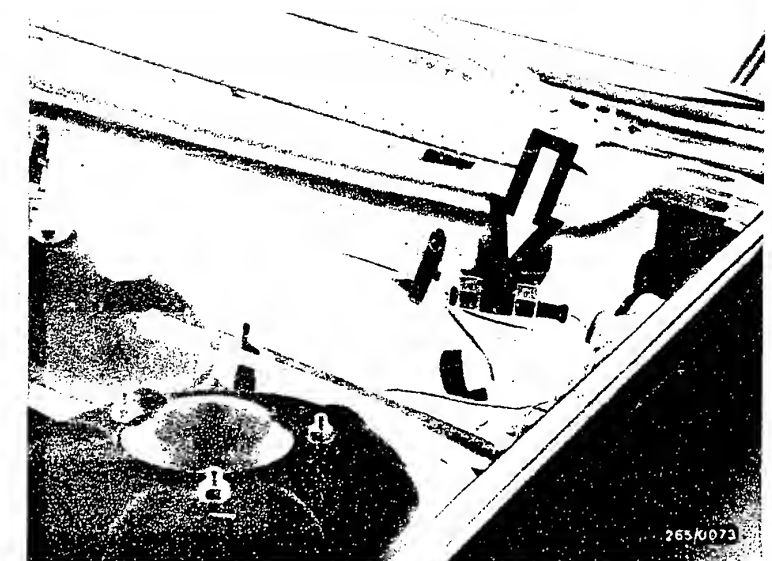
Trouble-shooting (switch off ignition):

1. Reading less than 30 mV: Have the tester checked.
2. Reading greater than 250 mV: Test ground terminal (under fuse box on wheel box) for high contact resistance and open circuit. Ground terminal must be bare down to the metal and must be securely tightened.

Test cable 20 for open circuit:
From ground to multiple plug K1/term.20

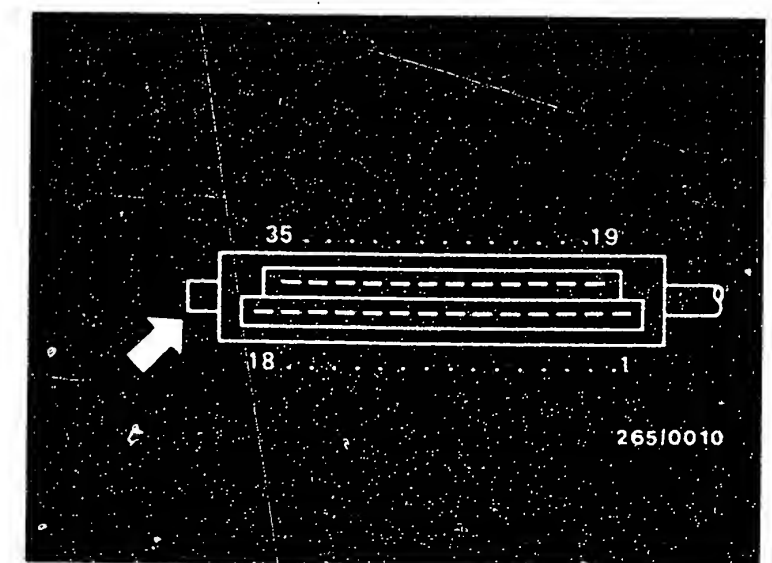


TEST STEP 11			
Operation:		Reading:	Testing:
Program-selector switch position	10	Digital display unit: for FL and FR: <u>0.8 ... 1.8 kΩ¹⁾</u> If reading OK, continue testing with <u>next test step.</u>	<u>Component:</u> Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●		<u>Operation:</u> Internal resistance
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading less than 0.8 kΩ or greater than 1.8 kΩ



Arrow = Wheel-speed sensor plug connector in engine compartment

Top view of multiple plug K1 (35-pin) with terminal numbers
 Arrow = Lug with mechanical coding



1) Note:

The customer complaint
"indicator lamp lighting up occasionally; after renewed starting or actuation of the on/off switch indicator lamp stays off"
 may possibly be due to a loose contact in the wheel-speed sensor cables or the 2-pin wheel-speed sensor plug connectors. The problem is due to temporary open-circuits or touching of wires, caused by vibrations or changes in loading.

Locate the fault using the following test method.

Continued on D7/D8

D5

Test with ABS tester
 BMW 7 series



D6

Test with ABS tester
 BMW 7 series



Trouble-shooting for TEST STEP 11 (continued)

Method of testing for loose contacts on wheel-speed sensors:

- One after the other, select all 4 wheel-speed sensors by pressing the respective key.
- When a wheel-speed sensor has been selected, move, bend and pull the appropriate cable directly at the wheel-speed sensor and at the fastening points, and do the same to the 2-pin plug connector.
- At the same time watch the digital display on the tester:
If the digital display changes sharply there is a loose contact. If there is an open circuit the display rises (max. 999); if there is a short circuit (usually at the wiring-harness plug) the reading falls (min. 000).
- Replace wheel-speed sensor.

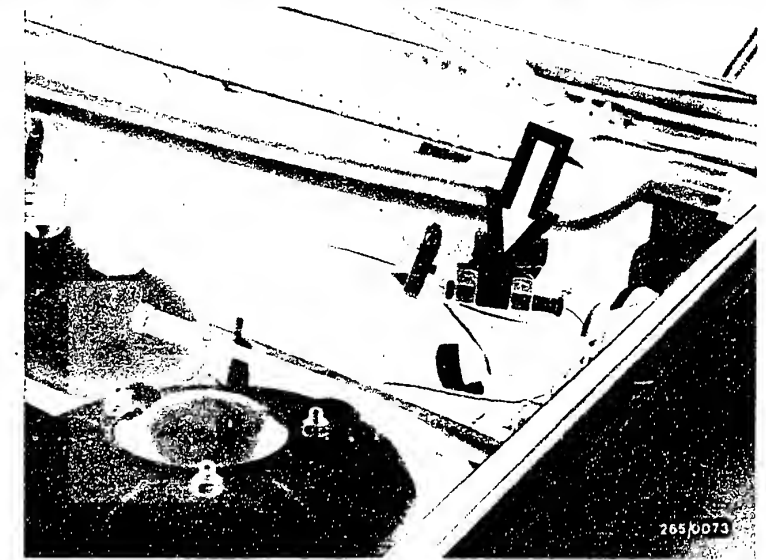
Testing the wheel-speed sensor plug connectors:

- If the wheel-speed sensor cables are OK, the 2-pin plug connectors of the wheel-speed sensors on the wiring harness side must be tested in the same manner for loose contacts.
- If there is a loose contact at a 2-pin plug connector (wiring harness side) it must be repaired with the repair kit.

Repairing the plug connectors

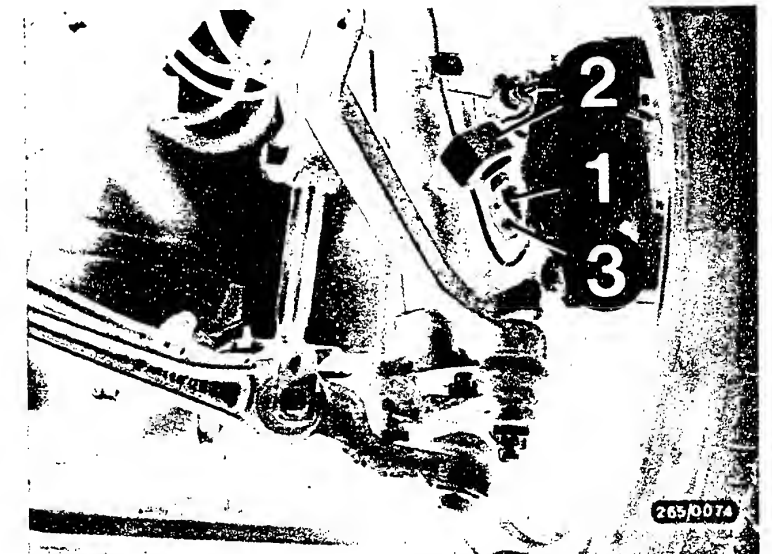
- Disconnect battery.
- Undo wheel-speed sensor plug connectors for front wheels in engine compartment 25 mm after the wiring-harness plug. Undo wheel-speed sensor plug connectors for rear wheels under rear seat bench 150 mm after the wiring-harness plug.

Continued on D9/D10



Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



D7

Test with ABS tester
BMW 7 series



D8

Test with ABS tester
BMW 7 series



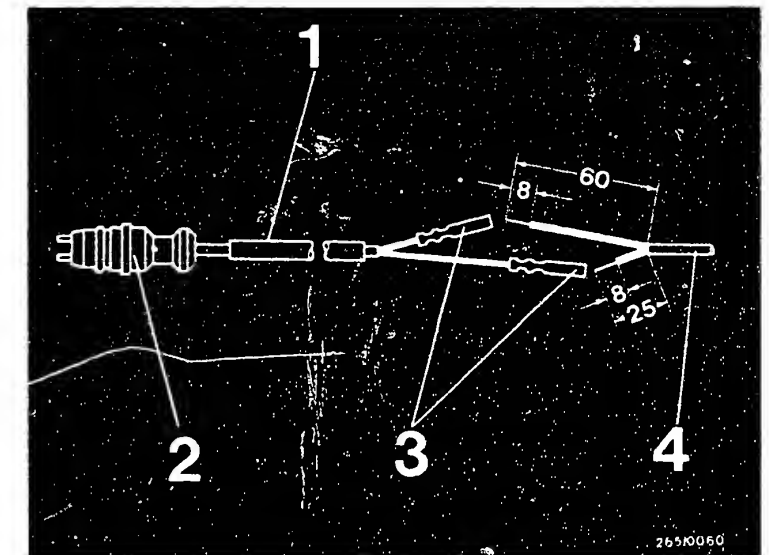
Trouble-shooting for TEST STEP 11 (continued)

- Carefully remove the outer black insulation over a length of 60 mm. Under no circumstances may the insulation of the two inner wires be damaged.
- Shorten a cable to 25 mm and strip off the insulation at both ends over approx. 8 mm (sketch).
- Using Eisemann crimping tool, carefully crimp on new wheel-speed sensor plug connectors to prevent renewed complaints.
- Slip shrinkable hose over the crimped connection and heat with a hairdryer. Temperature must be at least 125°C since the shrinkable hose is coated on the inside with a thermo-adhesive.
Perform the work carefully so that the repair is moisture-proof.
To avoid having to replace the entire wiring harness, BMW offers a repair kit for repairing the plug connector (wiring harness side). (It is also possible to use the corresponding Audi repair kit).

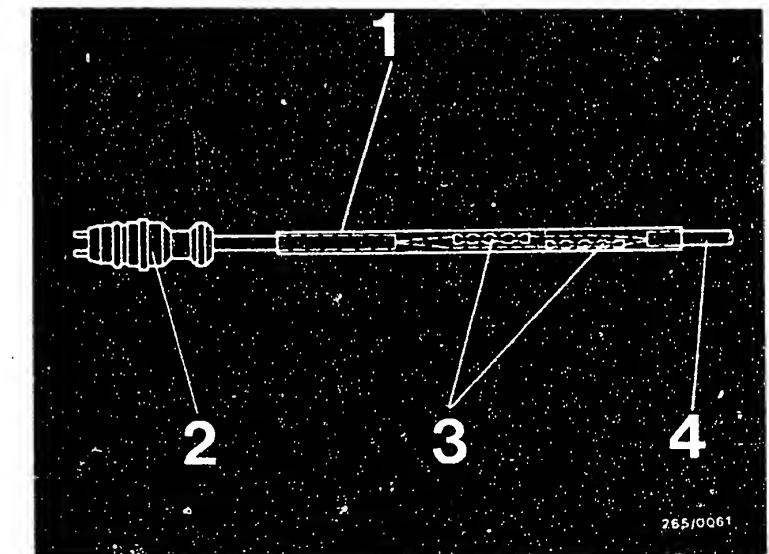
The repair kit consists of a connector with stripped cable ends and shrinkable insulating hose.

If necessary, repair kits are to be obtained from VAG or BMW dealers.

Continued on D11/D12



- 1 = Shrinkable hose
- 2 = Repair connector
- 3 = Crimp-on terminals
- 4 = ABS wiring harness



D9

Test with ABS tester
BMW 7 series



D10

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 11 (continued)

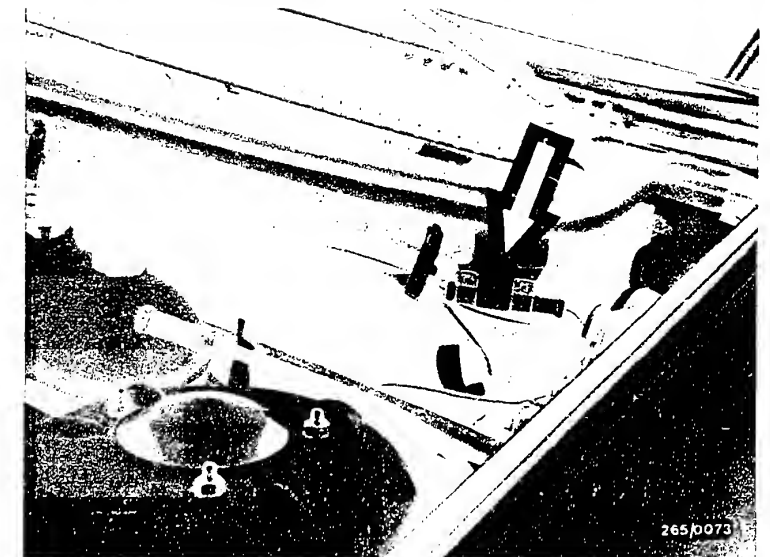
Trouble-shooting (switch off ignition)

1. Measure internal resistance at detached connectors.
If nominal value not reached: replace wheel-speed sensor.
2. Test cables (6) and (4) for continuity:
From plug K 11 to multiple plug K1/term.6 and term.4
From plug K 13 to multiple plug K1/term.23 and term.21.
3. Check plug connectors.

Removing wheel-speed sensors on front axle

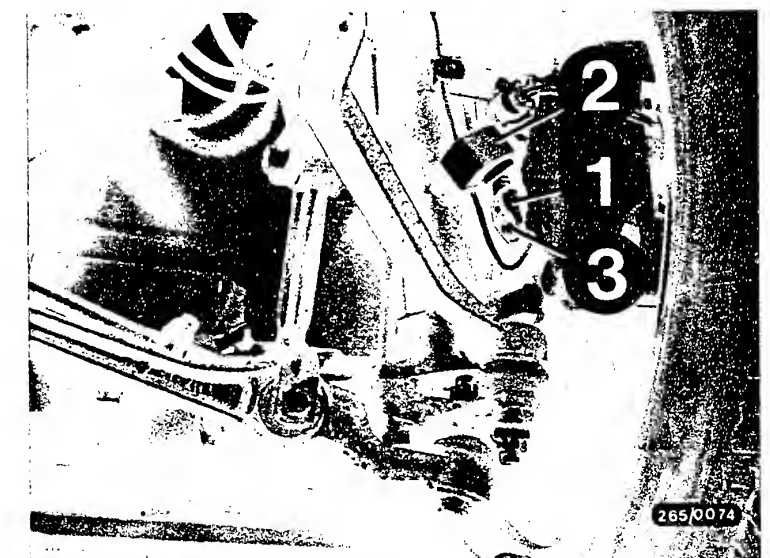
- Undo plug connector (top picture - arrow) in engine compartment.
- Installation positions of plug connectors:
In engine compartment on left and right on firewall.
- Take plug connector out of holder and undo.
- Loosen cable mountings and push back rubber sleeve over wheel-speed sensor.
- Loosen fastening screw (3) and pull out wheel-speed sensor. Do not use force.

Continued on D13/D14



Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



D11

Test with ABS tester
BMW 7 series



D12

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 11 (continued)

Installing wheel-speed sensors on front axle

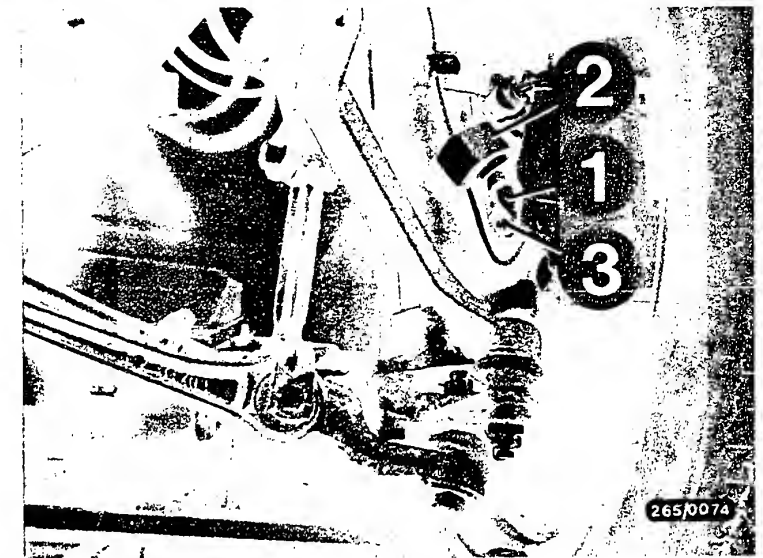
Note: The wheel-speed sensors for the front wheels are installed without shim rings.

- Check O-ring and rubber sleeve for cracks. Replace if necessary.
- Grease wheel-speed-sensor housing with Molykote Longterm 2.

Caution!

Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Press wheel-speed sensor into mounting hole. Do not hit.
Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve correctly.
- Pull cable up into engine compartment and connect to ABS wiring harness by means of the 2-pin plug connector.
- Fully test the ABS with the tester.



- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw

D 13

Test with ABS tester
BMW 7 series



D 14

Test with ABS tester
BMW 7 series



TEST STEP 12			
Operation:		Reading:	Testing:
Program-selector switch position	10	Digital display unit must indicate $0.6 \dots 1.6 \text{ k}\Omega$ ¹⁾	<u>Component:</u> Wheel-speed sensors rear left and rear right <u>Operation:</u> Internal resistance <u>Malfunction:</u> Reading less than $0.6 \text{ k}\Omega$ or greater than $1.6 \text{ k}\Omega$
Press keys RL and RR one after the other.	●	If reading OK, continue testing with next test step.	
<u>Operation in vehicle:</u> Switch on ignition			

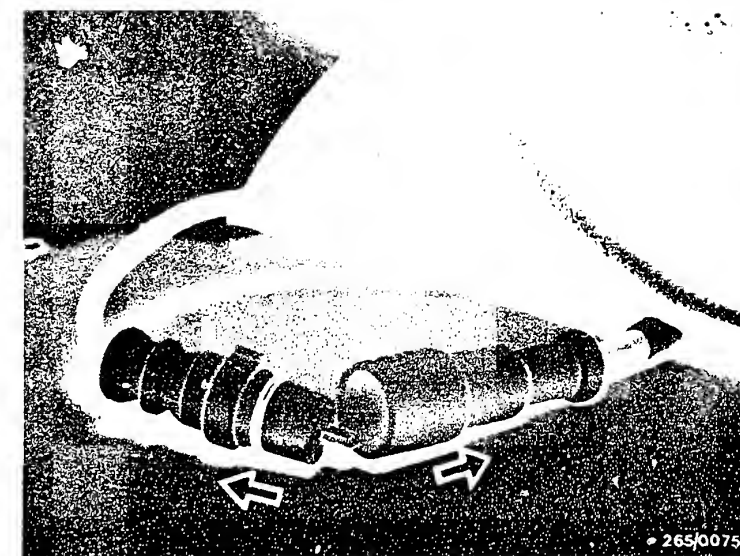
1)

Note:

The customer complaint "indicator lamp lighting up occasionally; after renewed starting or actuation of the on/off switch indicator lamp stays off" may possibly be due to a loose contact in the wheel-speed sensor cables or the 2-pin wheel-speed sensor plug connectors. The problem is due to temporary open-circuits or touching of wires, caused by vibrations or changes in loading.

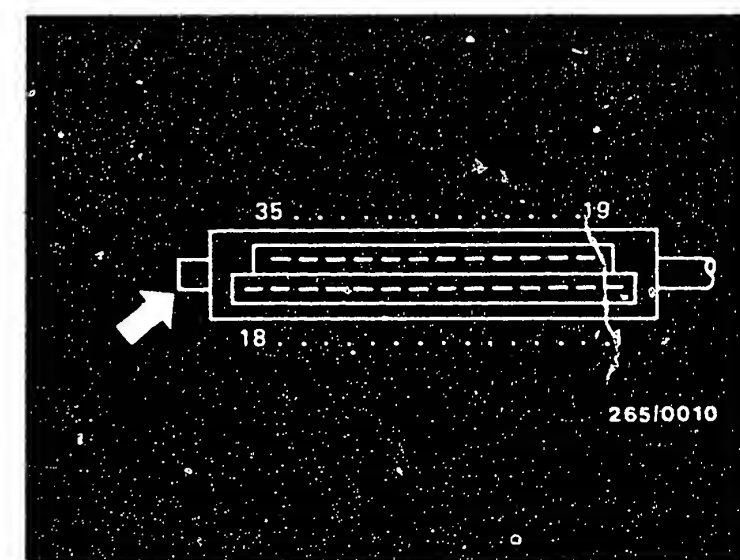
Locate the fault using the following test method.

Continued on D17/D18



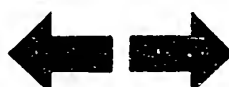
Arrow = Wheel-speed sensor plug connector under rear seat

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding



D 15

Test with ABS tester
BMW 7 series



D 16

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 12 (continued)

Method of testing for loose contacts on wheel-speed sensors:

- One after the other, select all 4 wheel-speed sensors by pressing the respective key.
- When a wheel-speed sensor has been selected, move, bend and pull the appropriate cable directly at the wheel-speed sensor and at the fastening points, and do the same to the 2-pin plug connector.
- At the same time watch the digital display on the tester:
If the digital display changes sharply there is a loose contact. If there is an open circuit the display rises (max. 999); if there is a short circuit (usually at the wiring-harness plug) the reading falls (min. 000).
- Replace wheel-speed sensor.

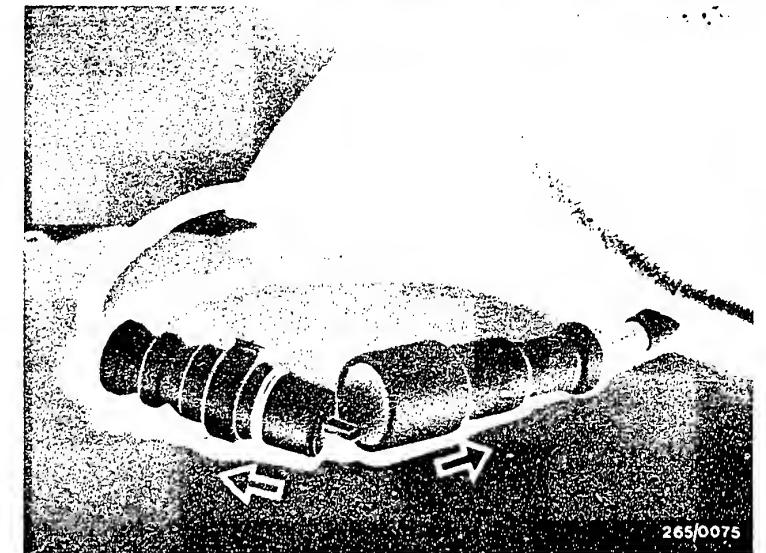
Testing the wheel-speed sensor plug connectors:

- If the wheel-speed sensor cables are OK, the 2-pin plug connectors of the wheel-speed sensors on the wiring harness side must be tested in the same manner for loose contacts.
- If there is a loose contact at a 2-pin plug connector (wiring harness side) it must be repaired with the repair kit.

Repairing the plug connectors

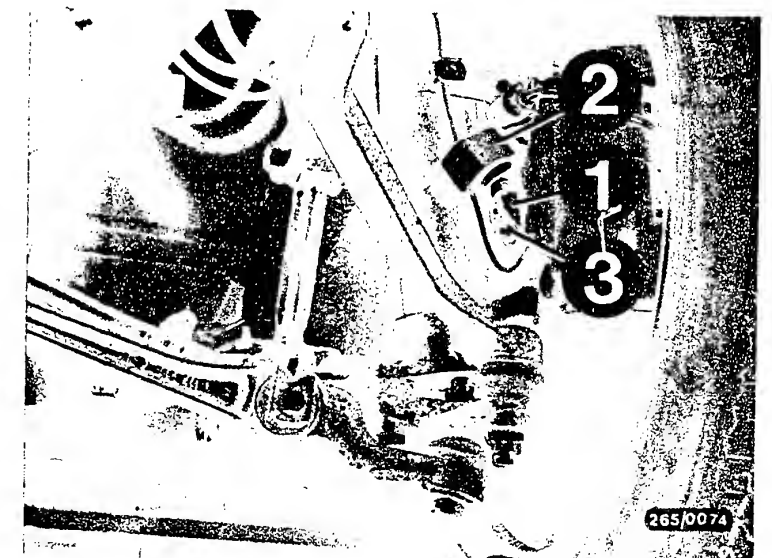
- Disconnect battery.
- Undo wheel-speed sensor plug connectors for front wheels in engine compartment 25 mm after the wiring-harness plug. Undo wheel-speed sensor plug connectors for rear wheels under rear seat bench 150 mm after the wiring-harness plug.

Continued on D19/D20



Arrow = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



D17

Test with ABS tester
BMW 7 series



D18

Test with ABS tester
BMW 7 series



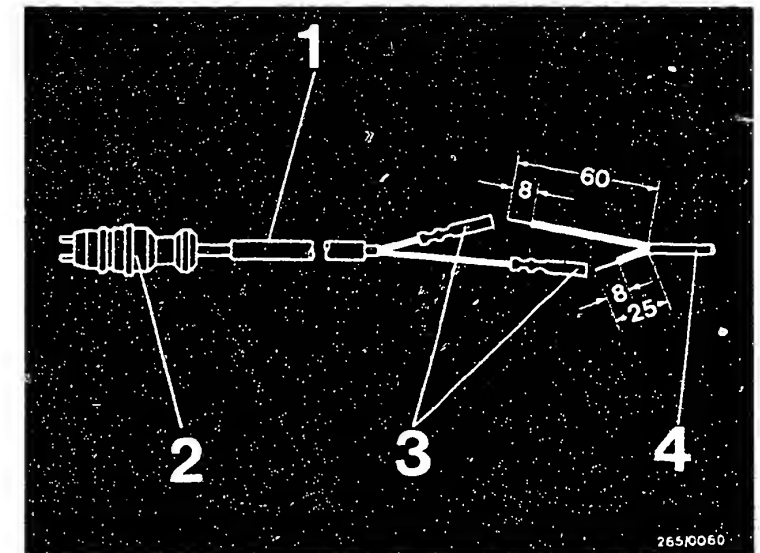
Trouble-shooting for TEST STEP 12 (continued)

- Carefully remove the outer black insulation over a length of 60 mm. Under no circumstances may the insulation of the two inner wires be damaged.
- Shorten a cable to 25 mm and strip off the insulation at both ends over approx. 8 mm (sketch).
- Using Eisemann crimping tool, carefully crimp on new wheel-speed sensor plug connectors to prevent renewed complaints.
- Slip shrinkable hose over the crimped connection and heat with a hairdryer. Temperature must be at least 125°C since the shrinkable hose is coated on the inside with a thermo-adhesive.
Perform the work carefully so that the repair is moisture-proof.
To avoid having to replace the entire wiring harness, BMW offers a repair kit for repairing the plug connector (wiring harness side). (It is also possible to use the corresponding Audi repair kit).

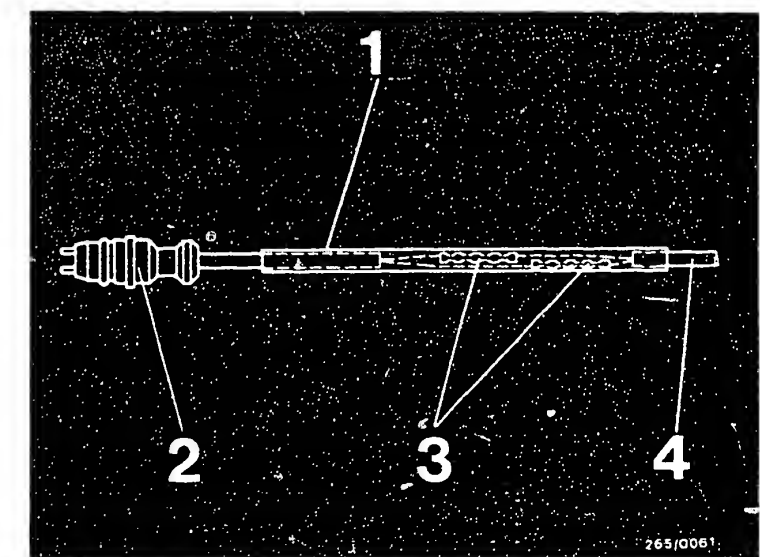
The repair kit consists of a connector, pre-assembled plug connectors and shrinkable insulating hose.

If necessary, repair kits are to be obtained from VAG or BMW dealers.

Continued on D21/D22



- 1 = Shrinkable hose
- 2 = Repair connector
- 3 = Crimp terminals
- 4 = ABS wiring harness



D 19

Test with ABS tester
BMW 7 series



D 20

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 12 (continued)

Trouble-shooting (switch off ignition)

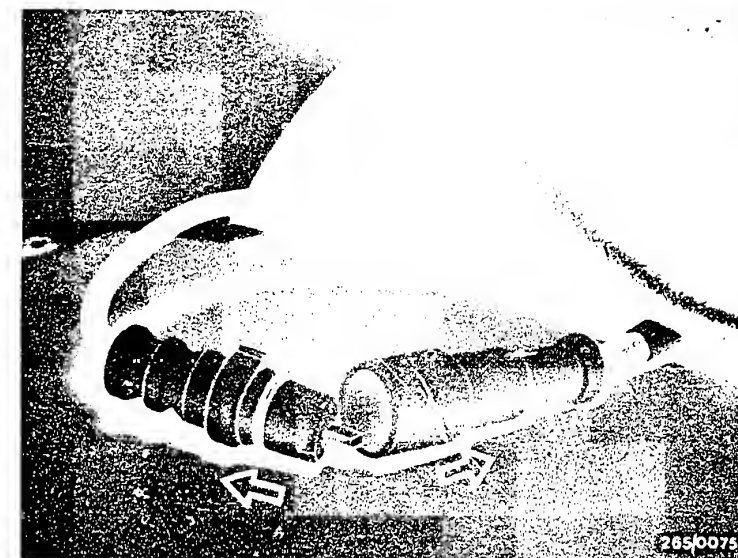
1. Measure internal resistance at detached connectors. If nominal value not reached: replace corresponding wheel-speed sensor.
2. Test cables ⑦, ⑨, ②④ and ②⑥ for continuity:
From plug K 15 to multiple plug K1/term.7 and term.9.
From plug K 17 to multiple plug K1/term.24 and term.26.
3. Check plug connector.

Removing wheel-speed sensors on rear axle

- Rear wheels can be removed to facilitate replacement of the wheel-speed sensors.
- Switch off ignition.
- Remove rear seat.
- Undo plug connector under rear seat.
- Pull out the wheel-speed sensor cable (with connector) to the left-hand or right-hand rear axle as the case may be.
- Push back rubber sleeve (2).
- Loosen hexagon-socket-head cap screw (3) and pull out wheel-speed sensor (1).
Do not use force.

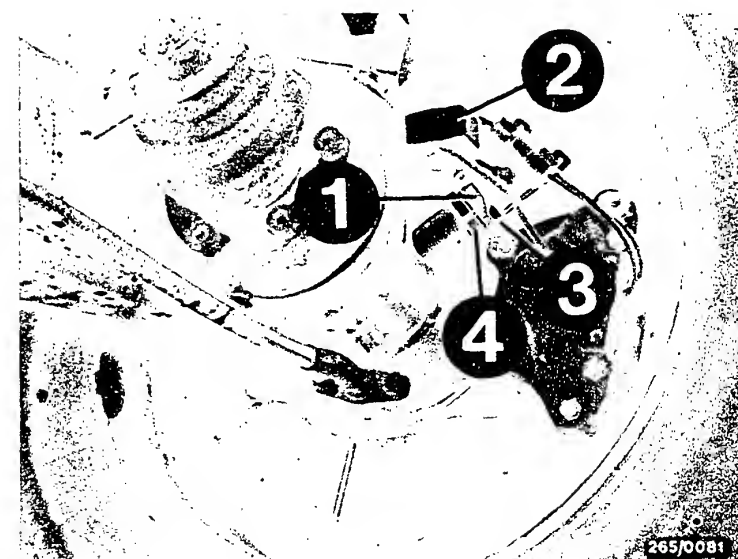
Caution!

If there are any shim rings (4) on the two rear-axle wheel-speed sensors, do not mix them up. Different thickness possible.



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



D21

Test with ABS tester
BMW 7 series



D22

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 12 (continued)

Installing wheel-speed sensors on rear axle

Notes for wheel-speed sensors with shim rings

If re-using the same wheel-speed sensors, make sure that the shim rings of the left-hand and right-hand wheel-speed sensors are not mixed up.

Before installing a new wheel-speed sensor, establish the correct size of shim ring.

Do not install wheel-speed sensors without shim ring. Danger of damage!

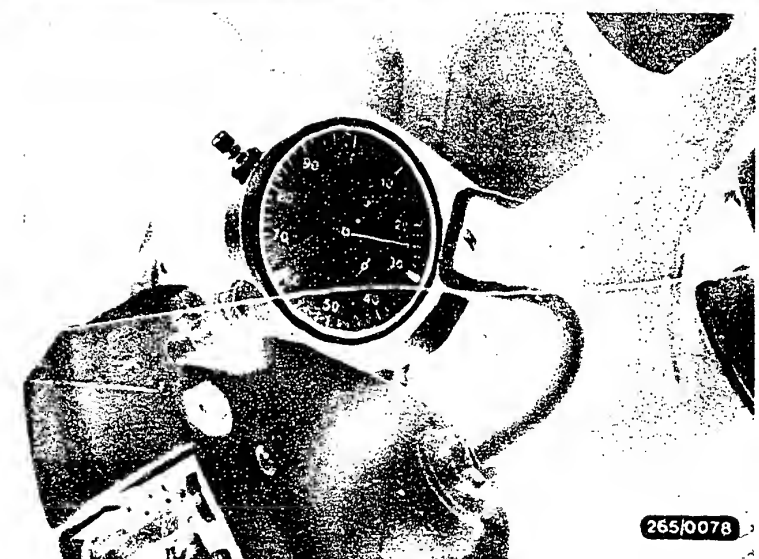
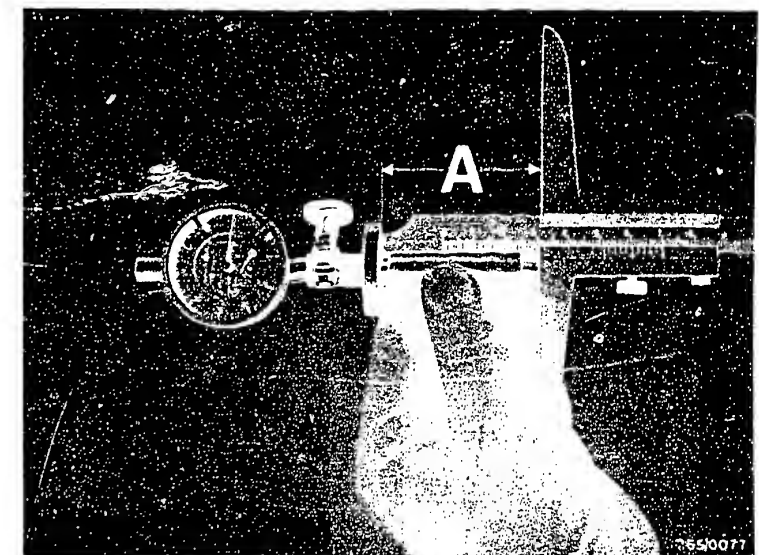
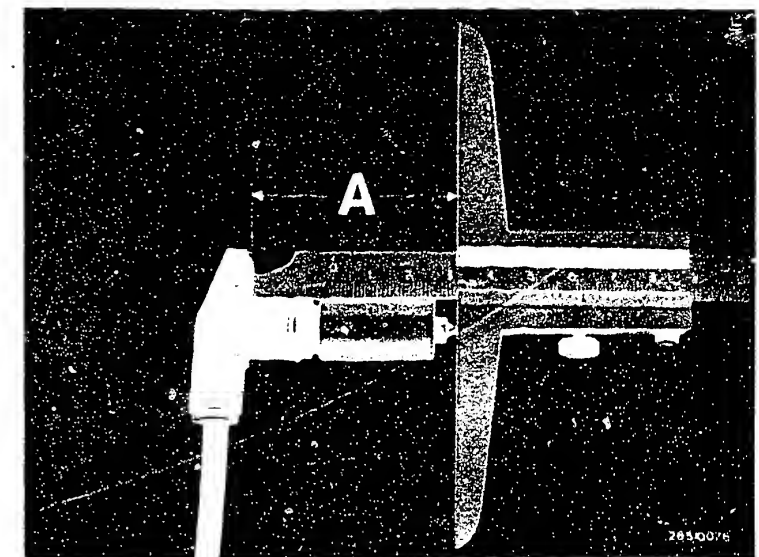
Calculating the air gap

- Using depth calliper, measure dimension "A" on new wheel-speed sensor and make a note. Do not tilt depth calliper.
- Hold depth calliper with dimension "A" against depth gauge with dial indicator and set dial indicator to zero with a slight preload. The installation dimension of the new wheel-speed sensor has now been transferred to the depth gauge.
- Insert depth gauge KDAS 0001 into wheel-speed sensor mounting hole as far as it will go.
- Read off difference and add air gap (0.25 mm). This gives the shim dimension. Choose the shim ring which is nearest in dimension to the shim dimension. Shim rings are in steps of 0.1 mm.

Example:

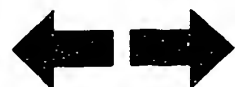
Difference read off on dial indicator: 2.26 mm. Plus 0.25 mm air gap gives 2.51 mm.
Install 2.50 mm shim ring (dimensionally the nearest).

Continued on E1/E2



D23

Test with ABS tester
BMW 7 series



D24

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 12 (continued)

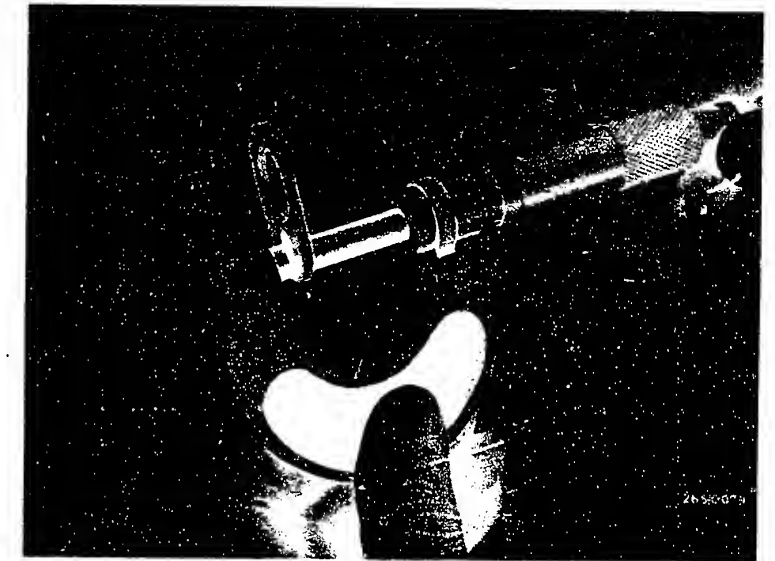
Valid for all models:

- Check O-ring (1) and rubber sleeve (2) for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

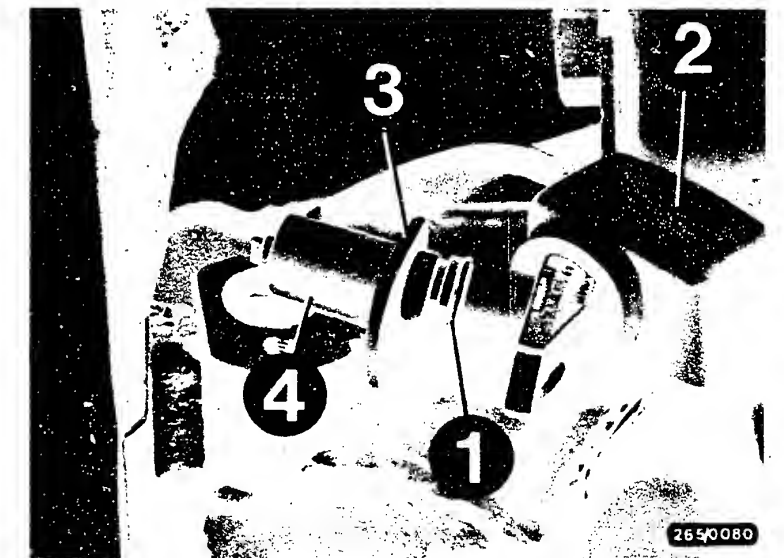
Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Correct shim ring fitted?
Be sure to check thickness of shim ring with micrometer screw.
- Press wheel-speed sensor into mounting hole. Do not hit. Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve properly.
- Run cable under rear seat and connect to wiring harness.
- Fully test ABS with tester.



Measuring the shim ring with micrometer screw

- 1 = O-ring
- 2 = Rubber sleeve
- 3 = Shim ring
- 4 = Wheel-speed sensor housing



E1

Test with ABS tester
BMW 7 series

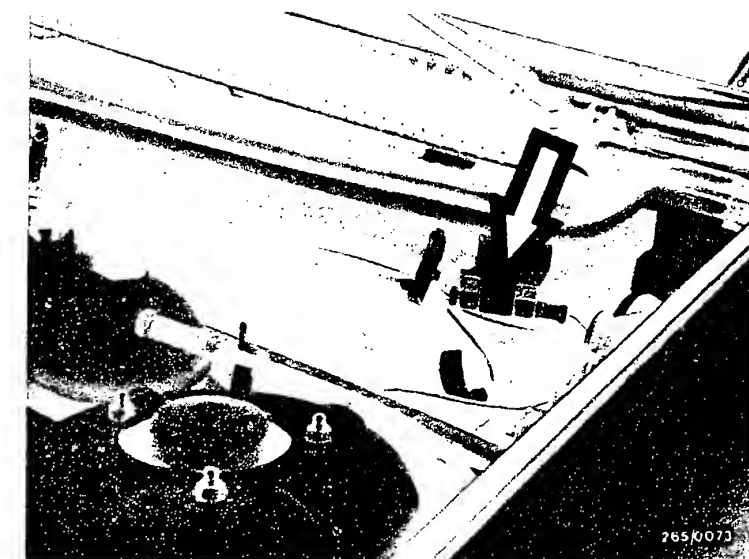


E2

Test with ABS tester
BMW 7 series



TEST STEP 13			
Operation:		Reading:	Testing:
Program-selector switch position	11	Digital display unit: for FL and FR: <u>20 ... 999 k Ω</u>	<u>Component:</u> Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●		<u>Operation:</u> Insulation resistance
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading less than 20 k Ω



Arrows = Wheel-speed sensor plug connector in engine compartment

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

Trouble-shooting (switch off ignition):

Plug connectors OK?

Undo plug connectors and bridge the plug leading to the tester using wire.

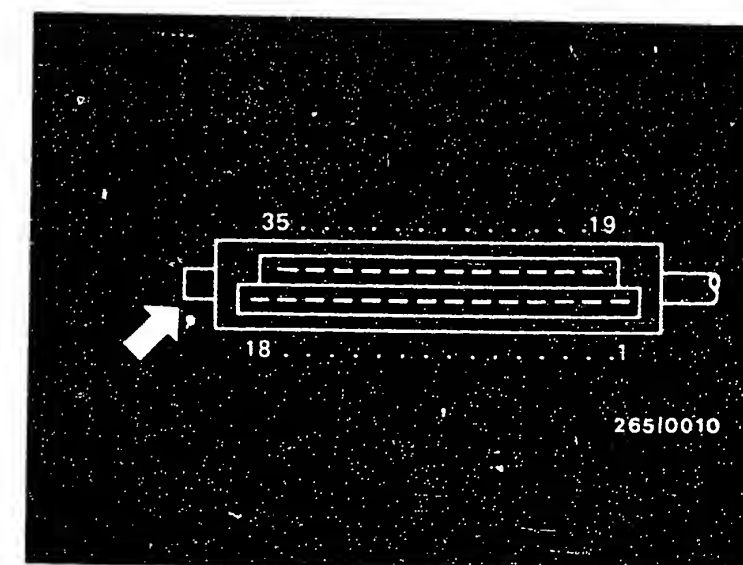
Repeat test:

If reading now OK, replace wheel-speed sensor.

If reading still below the nominal value, the cables from multiple plug term.6 and term.4 or term.23 and term.21 to the respective plug are defective.

Check all cables for wear and short circuit to ground.

Continued on E5/E6



E3

Test with ABS tester
BMW 7 series



E4

Test with ABS tester
BMW 7 series

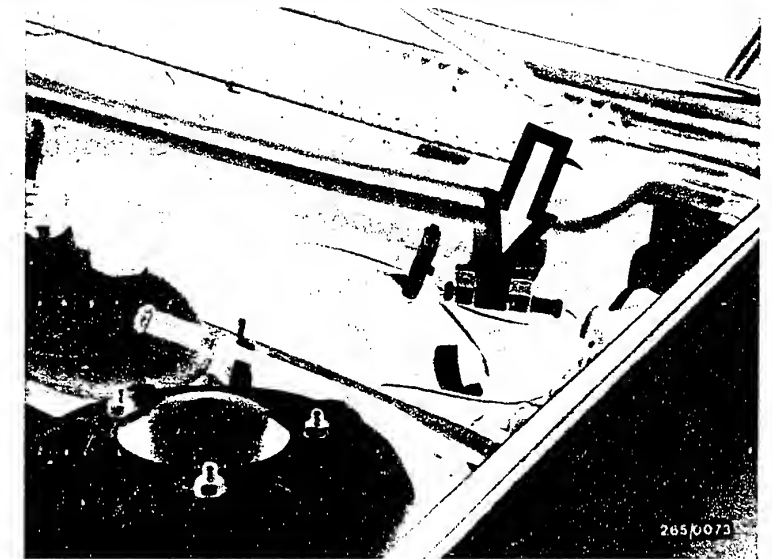


Trouble-shooting for TEST STEP 13 (continued)

Removing wheel-speed sensors on front axle

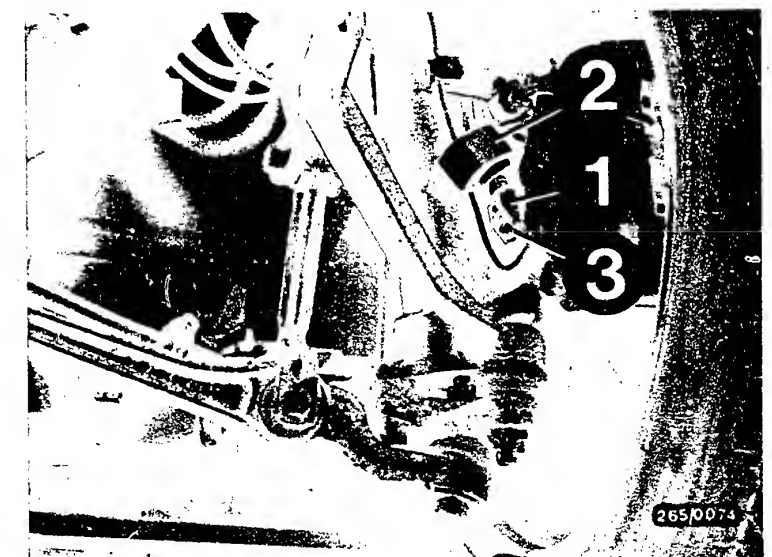
- Undo plug connector (top picture - arrow) in engine compartment.
- Installation positions of plug connectors:
In engine compartment on left and right on firewall.
- Take plug connector out of holder and undo.
- Loosen cable mountings and push back rubber sleeve over wheel-speed sensor.
- Loosen fastening screw (3) and pull out wheel-speed sensor. Do not use force.

Continued on E7/E8



Arrow = Wheel-speed sensor plug
connector in engine
compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



E5

Test with ABS tester
BMW 7 series



E6

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 13 (continued)

Installing wheel-speed sensors on front axle

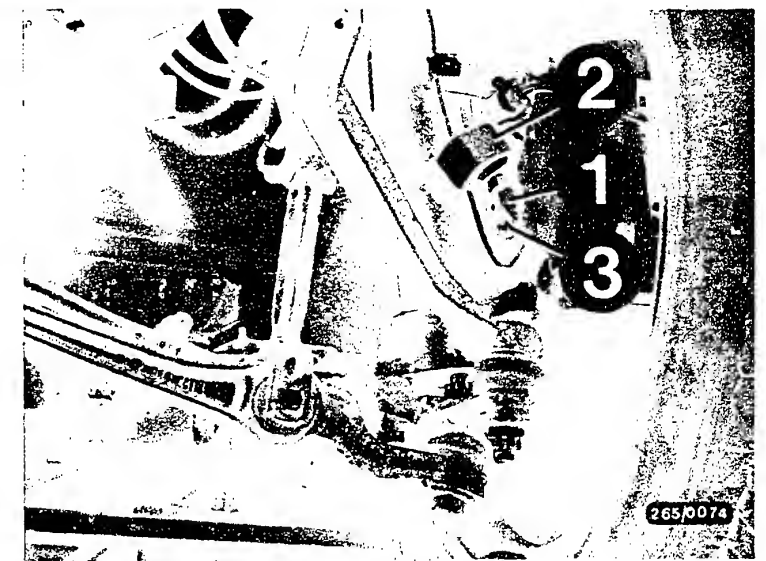
Note: The wheel-speed sensors for the front wheels are installed without shim rings.

- Check O-ring and rubber sleeve for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Press wheel-speed sensor into mounting hole. Do not hit.
Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve correctly.
- Pull cable up into engine compartment and connect to ABS wiring harness by means of the 2-pin plug connector.
- Fully test the ABS with the tester.



- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw

E7

Test with ABS tester
BMW 7 series

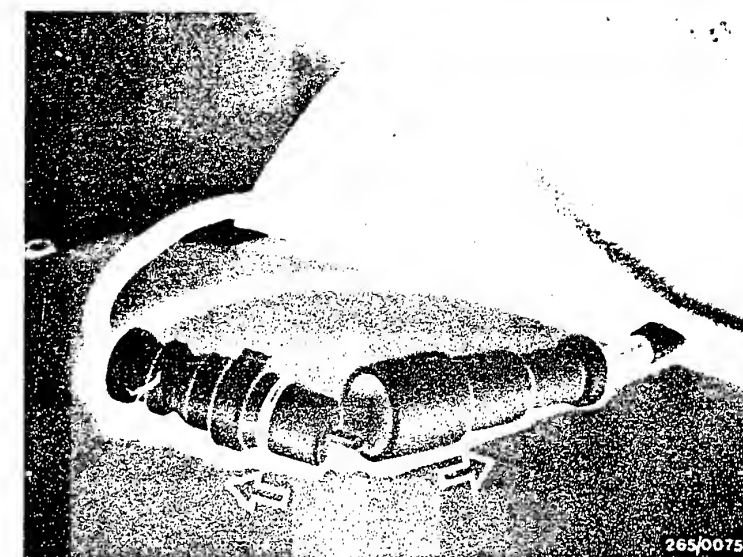


E8

Test with ABS tester
BMW 7 series

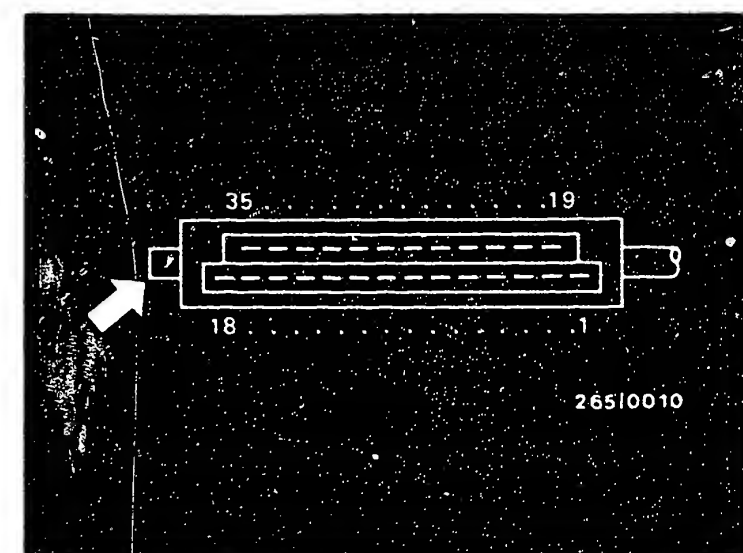


TEST STEP 14			
Operation:		Reading:	Testing:
Program-selector switch position	11	Digital display unit: for RL and RR: <u>20 ... 999 kΩ</u>	<u>Component:</u> Wheel-speed sensors rear left and rear right
Press keys RL and RR one after the other.	●		<u>Operation:</u> Insulation resistance
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading less than 20 k Ω



Arrows = Wheel-speed sensor plug connector under rear seat

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding



Trouble-shooting (switch off ignition):

Plug connectors OK?

Undo plug connectors and bridge the plug leading to the tester using wire.

Repeat test:

If reading now OK, replace wheel-speed sensor.

If reading still below the nominal value, the cables from multiple plug term.7 and term.⑨ or term.②④ and term.②⑥ to the respective plug are defective.

Check all cables for wear and short circuit to ground.

Continued on E11/E12

E9

Test with ABS tester
BMW 7 series



E10

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 14 (continued)

1. Measure internal resistance at detached connectors. If nominal value not reached: replace corresponding wheel-speed sensor.
2. Test cables ⑦, ⑨, ②④ and ②⑥ for continuity:
From plug K 15 to multiple plug K1/term.7 and term.9.
From plug K 17 to multiple plug K1/term.24 and term.26.
3. Check plug connector.

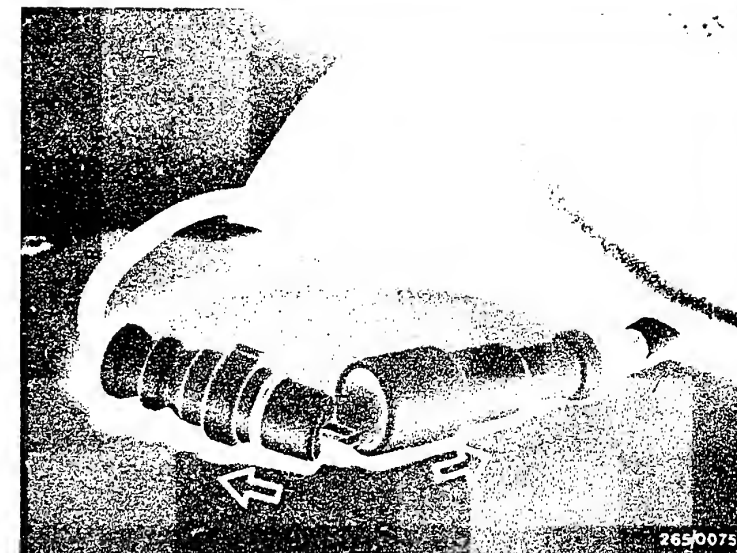
Removing wheel-speed sensors on rear axle

- Rear wheels can be removed to facilitate replacement of the wheel-speed sensors.
- Switch off ignition.
- Remove rear seat.
- Undo plug connector under rear seat.
- Pull out the wheel-speed sensor cable (with connector) to the left-hand or right-hand rear axle as the case may be.
- Push back rubber sleeve (2).
- Loosen hexagon-socket-head cap screw (3) and pull out wheel-speed sensor (1).
Do not use force.

Caution!

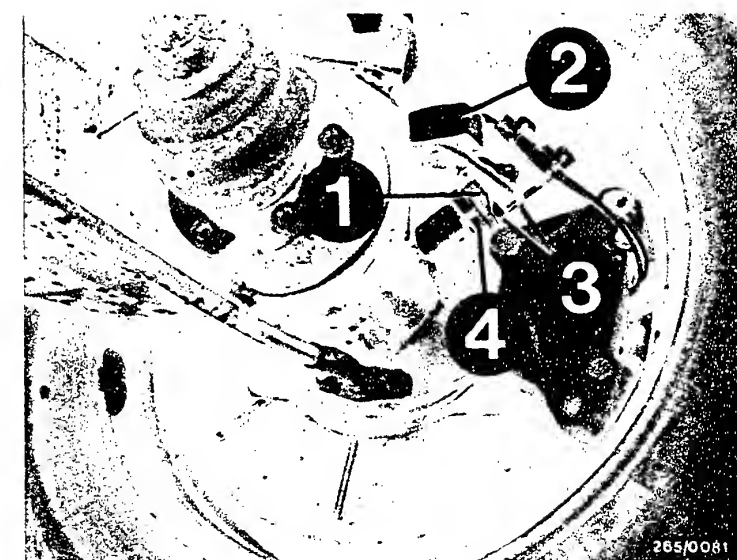
If there are any shim rings (4) on the two rear-axle wheel-speed sensors, do not mix them up. Different thickness possible.

Continued on E13/14



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



E11

Test with ABS tester
BMW 7 series



E12

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 14 (continued)

Installing wheel-speed sensors on rear axle

If re-using the same wheel-speed sensors, make sure that the shim rings of the left-hand and right-hand wheel-speed sensors are not mixed up.

Before installing a new wheel-speed sensor, establish the correct size of shim ring.

Do not install wheel-speed sensors without shim ring. Danger of damage!

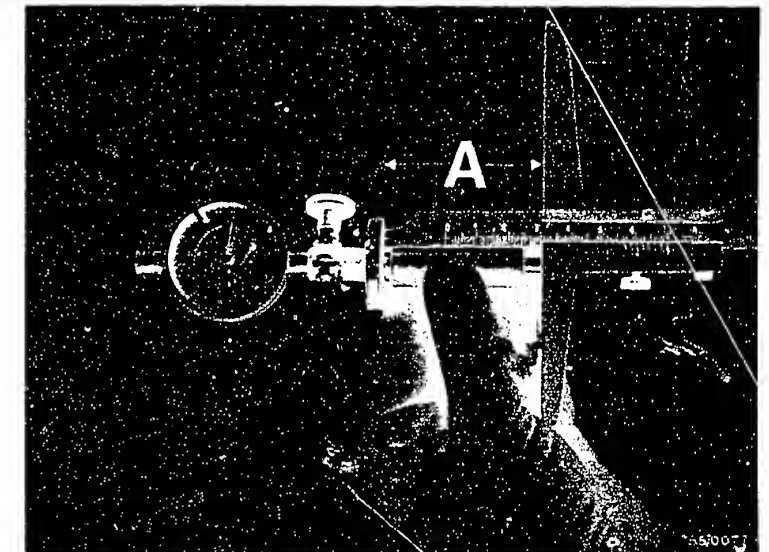
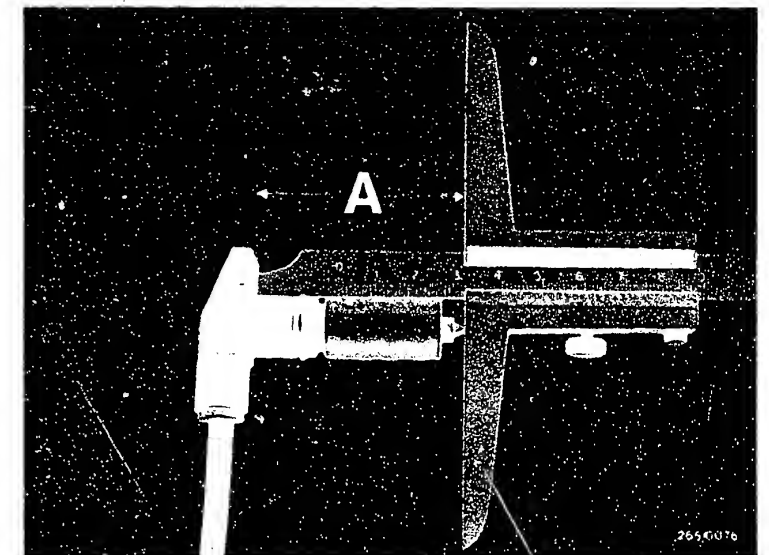
Calculating the air gap

- Using depth calliper, measure dimension "A" on new wheel-speed sensor and make a note. Do not tilt depth calliper.
- Hold depth calliper with dimension "A" against depth gauge with dial indicator and set dial indicator to zero with a slight preload. The installation dimension of the new wheel-speed sensor has now been transferred to the depth gauge.
- Insert depth gauge KDAS 0001 into wheel-speed sensor mounting hole as far as it will go.
- Read off difference and add air gap (0.25 mm). This gives the shim dimension. Choose the shim ring which is nearest in dimension to the shim dimension. Shim rings are in steps of 0.1 mm.

Example:

Difference read off on dial indicator: 2.26 mm. Plus 0.25 mm air gap gives 2.51 mm. Install 2.50 mm shim ring (dimensionally the nearest).

Continued on E15/E16



E13

Test with ABS tester
BMW 7 series



E14

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 14 (continued)

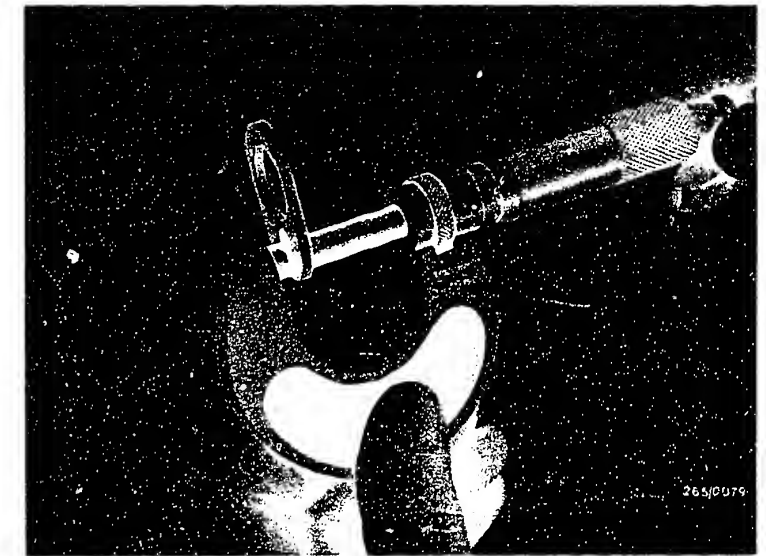
Valid for all models:

- Check O-ring (1) and rubber sleeve (2) for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

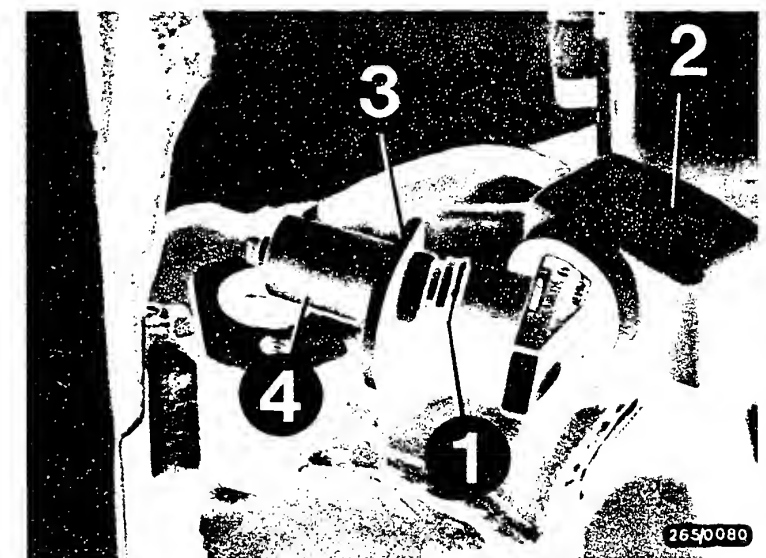
Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Correct shim ring fitted?
Be sure to check thickness of shim ring with micrometer screw.
- Press wheel-speed sensor into mounting hole. Do not hit. Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve properly.
- Run cable under rear seat and connect to wiring harness.
- Fully test ABS with tester.



Measuring the shim ring with micrometer screw

- 1 = O-ring
- 2 = Rubber sleeve
- 3 = Shim ring
- 4 = Wheel-speed sensor housing



E15

Test with ABS tester

BMW 7 series



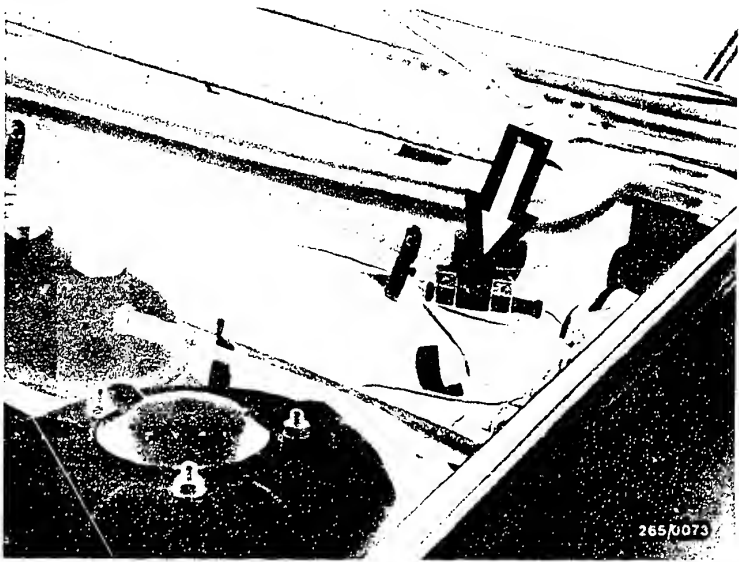
E16

Test with ABS tester

BMW 7 series



<u>TEST STEP 15</u>			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	12	Digital display unit: for FL and FR: <u>0 ... 100 mV</u> If reading OK, continue testing with <u>next test step.</u>	<u>Component:</u> Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●		<u>Operation:</u> DC voltage on cable
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading greater than 100 mV



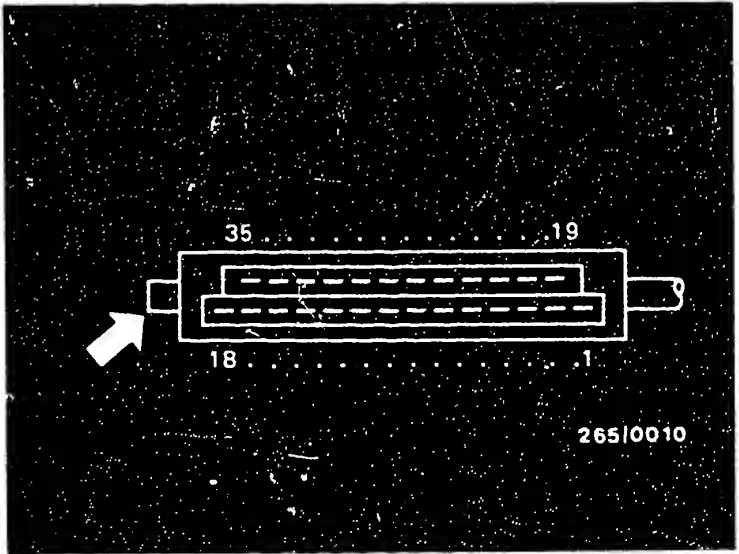
Arrow = Wheel-speed sensor plug connector in engine compartment

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

Trouble-shooting (switch off ignition):

Plug connectors OK?
Undo plug connectors and bridge the plug leading to the tester using wire.
Repeat test:
If reading now OK, replace wheel-speed sensor.
If reading still below the nominal value, the cables from multiple plug term.6 and term.4 or term.23 and term.21 to the respective plug are defective.
Check all cables for wear and short circuit to ground.

Continued on E19/E20

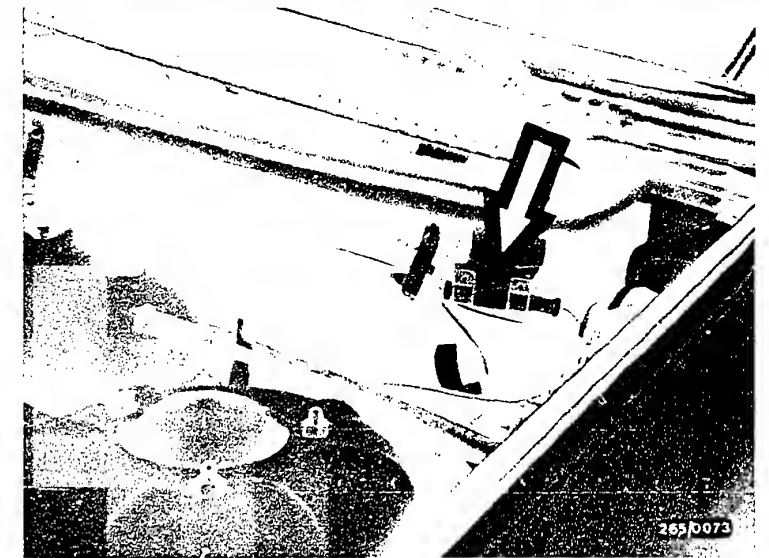


Trouble-shooting program for TEST STEP 15 (continued)

Removing wheel-speed sensors on front axle

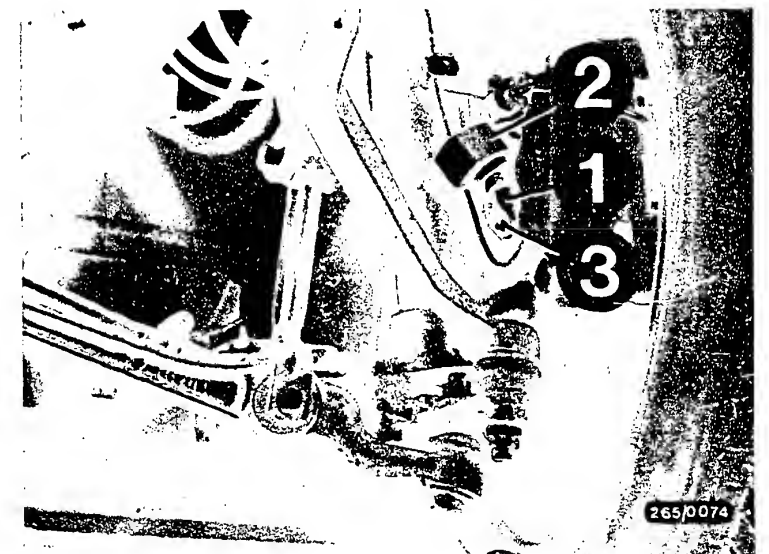
- Undo plug connector (top picture - arrow) in engine compartment.
- Installation positions of plug connectors:
In engine compartment on left and right on firewall.
- Take plug connector out of holder and undo.
- Loosen cable mountings and push back rubber sleeve over wheel-speed sensor.
- Loosen fastening screw (3) and pull out wheel-speed sensor. Do not use force.

Continued on E21/E22



Arrow = wheel-speed sensor plug
connector in engine
compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



E19

Test with ABS tester

BMW 7 series



E20

Test with ABS tester

BMW 7 series



Trouble-shooting for TEST STEP 15 (continued)

Installing wheel-speed sensors on front axle

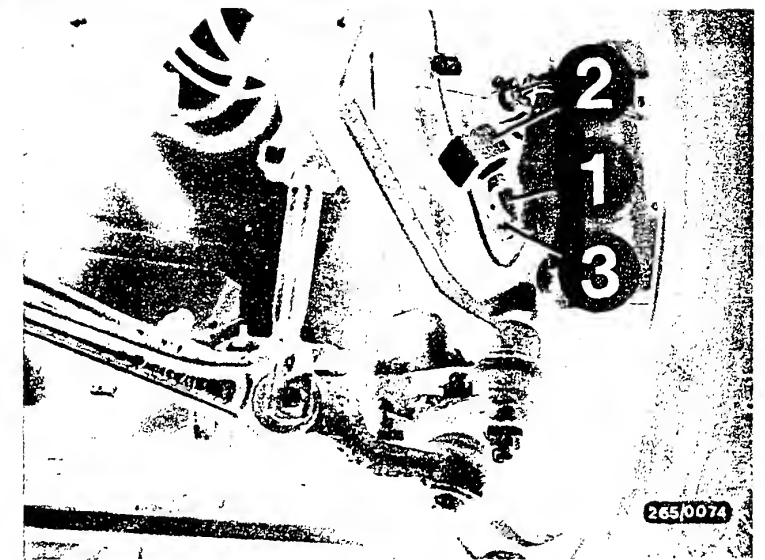
Note: The wheel-speed sensors for the front wheels are installed without shim rings.

- Check O-ring and rubber sleeve for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Press wheel-speed sensor into mounting hole. Do not hit.
Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve correctly.
- Pull cable up into engine compartment and connect to ABS wiring harness by means of the 2-pin plug connector.
- Fully test the ABS with the tester.



- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw

E21

Test with ABS tester

BMW 7 series



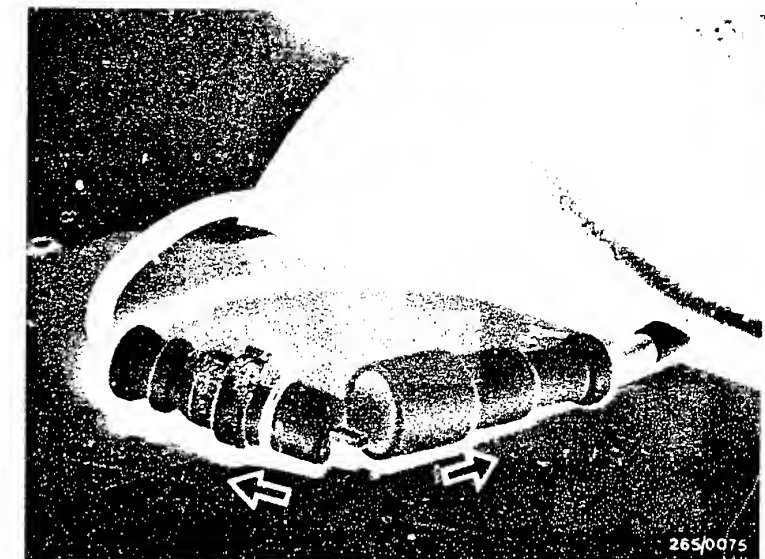
E22

Test with ABS tester

BMW 7 series



TEST STEP 16			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	12	Digital display unit must indicate <u>0 ... 100 mV.</u>	<u>Component:</u> Wheel-speed sensors rear left and rear right
Press keys RL and RR one after the other	●	If reading OK, continue testing with <u>next test step.</u>	<u>Operation:</u> DC voltage on cable
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading greater than 100 mV



Arrows = Wheel-speed sensor plug connector under rear seat

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding

Trouble-shooting (switch off ignition):

Plug connectors OK?

Undo plug connectors and bridge the plug leading to the tester using wire.

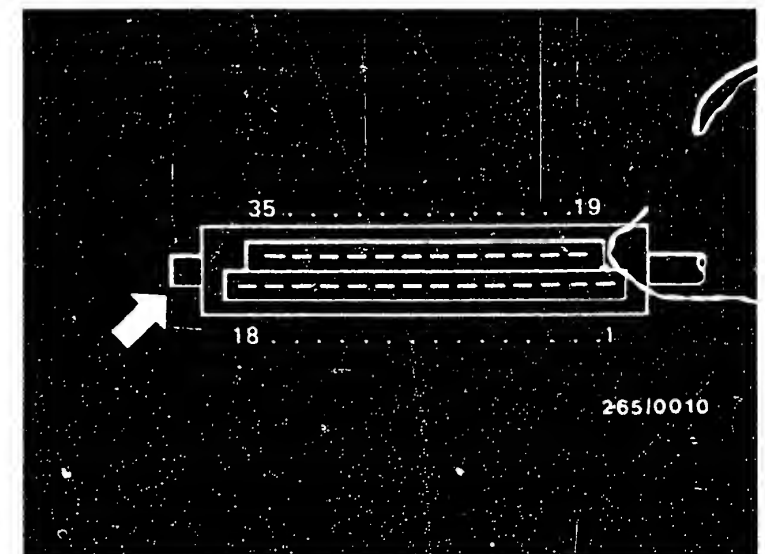
Repeat test:

If reading now OK, replace wheel-speed sensor.

If reading still below the nominal value, the cables from multiple plug term.7 and term.9 or term.24 and term.26 to the respective plug are defective.

Check all cables for wear and short circuit to ground.

Continued on F3/F4



F1

Test with ABS tester

BMW 7 series



F2

Test with ABS tester

BMW 7 series



Trouble-shooting for TEST STEP 16 (continued)

1. Measure internal resistance at detached connectors. If nominal value not reached: replace corresponding wheel-speed sensor.
2. Test cables ⑦, ⑨, ②④ and ②⑥ for continuity: From plug K 15 to multiple plug K1/term.7 and term.9 and from plug K 17 to multiple plug K1/term.24 and term.26.
3. Check plug connector.

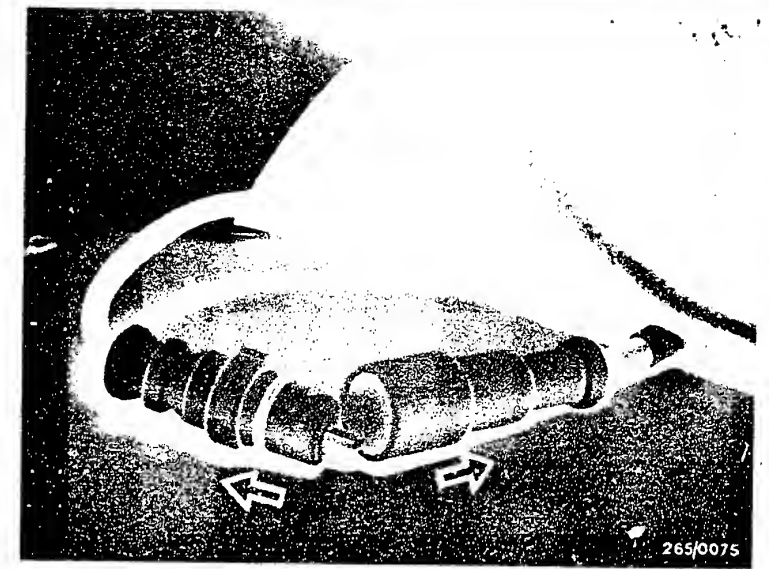
Removing wheel-speed sensors on rear axle

- Rear wheels can be removed to facilitate replacement of the wheel-speed sensors.
- Switch off ignition.
- Remove rear seat.
- Undo plug connector under rear seat.
- Pull out the wheel-speed sensor cable (with connector) to the left-hand or right-hand rear axle as the case may be.
- Push back rubber sleeve (2).
- Loosen hexagon-socket-head cap screw (3) and pull out wheel-speed sensor (1). Do not use force.

Caution!

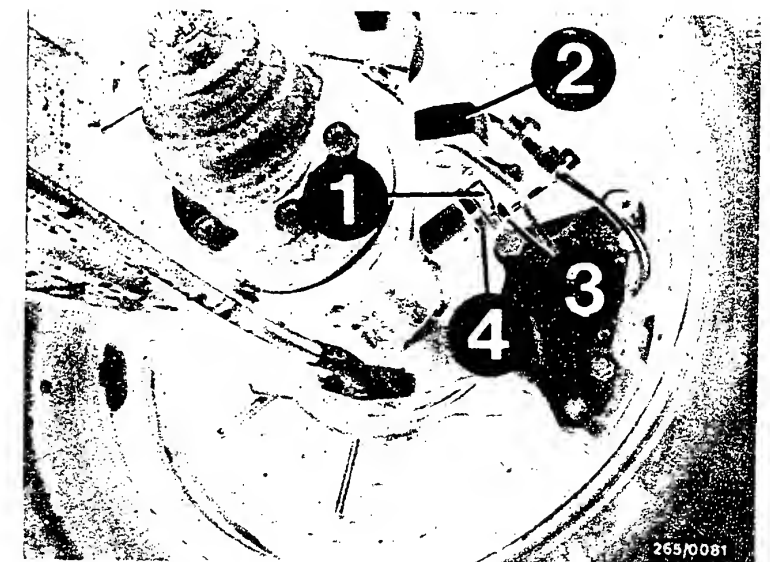
If there are any shim rings (4) on the two rear-axle wheel-speed sensors, do not mix them up. Different thickness possible.

Continued on F5/F6



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



F3

Test with ABS tester
BMW 7 series



F4

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 16 (continued)

Installing wheel-speed sensors on rear axle

Notes on wheel-speed sensors with shim rings:

If re-using the same wheel-speed sensors, make sure that the shim rings of the left-hand and right-hand wheel-speed sensors are not mixed up.

Before installing a new wheel-speed sensor, establish the correct size of shim ring.

Do not install wheel-speed sensors without shim ring. Danger of damage!

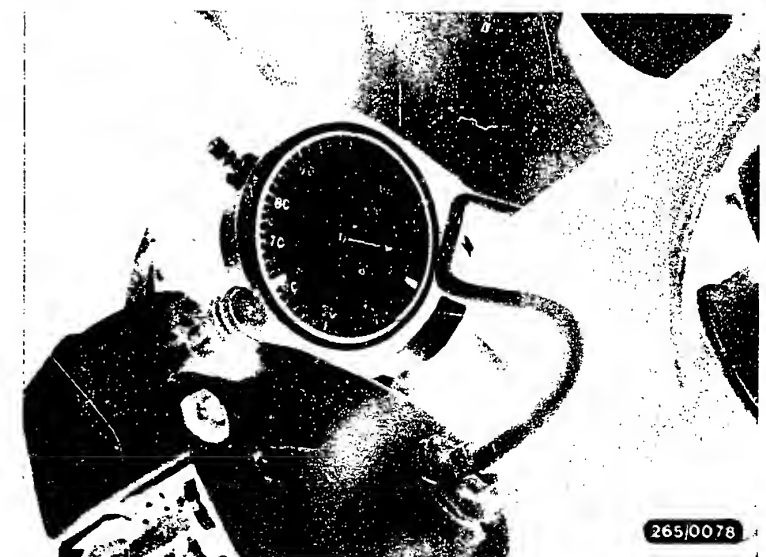
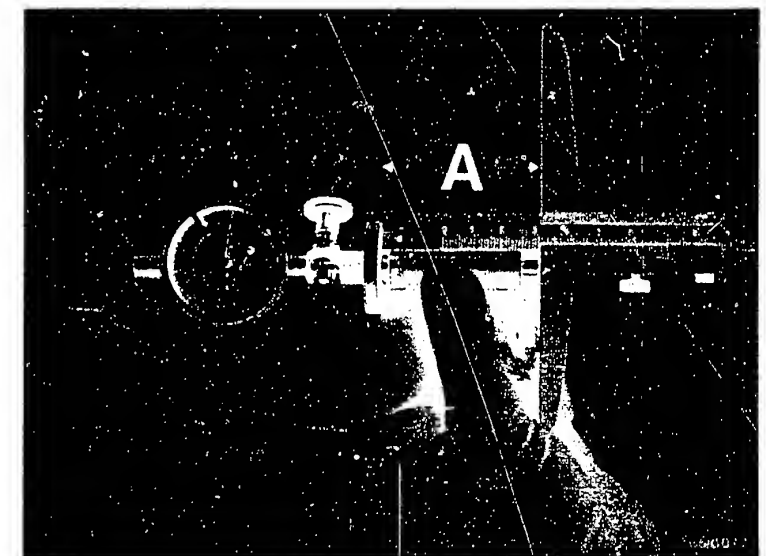
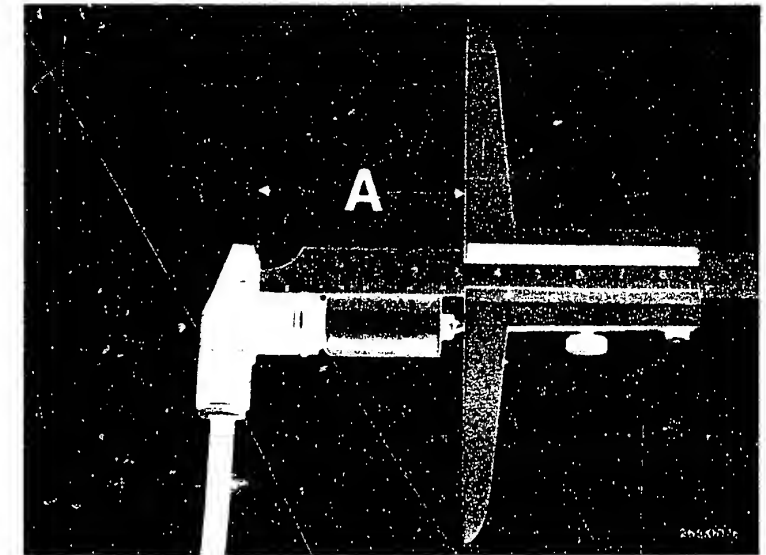
Calculating the air gap

- Using depth calliper, measure dimension "A" on new wheel-speed sensor and make a note. Do not tilt depth calliper.
- Hold depth calliper with dimension "A" against depth gauge with dial indicator and set dial indicator to zero with a slight preload. The installation dimension of the new wheel-speed sensor has now been transferred to the depth gauge.
- Insert depth gauge KDAS 0001 into wheel-speed sensor mounting hole as far as it will go.
- Read off difference and add air gap (0.25 mm). This gives the shim dimension. Choose the shim ring which is nearest in dimension to the shim dimension. Shim rings are in steps of 0.1 mm.

Example:

Difference read off on dial indicator: 2.26 mm. Plus 0.25 mm air gap gives 2.51 mm. Install 2.50 mm shim ring (dimensionally the nearest).

Continued on F7/F8



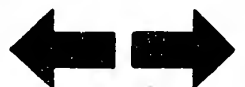
F5

Test with ABS tester
BMW 7 series



F6

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 16 (continued)

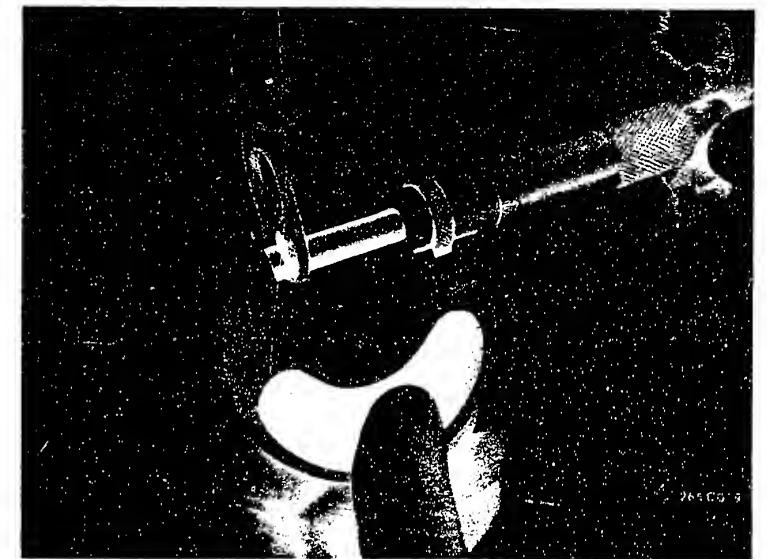
Valid for all models:

- Check O-ring (1) and rubber sleeve (2) for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

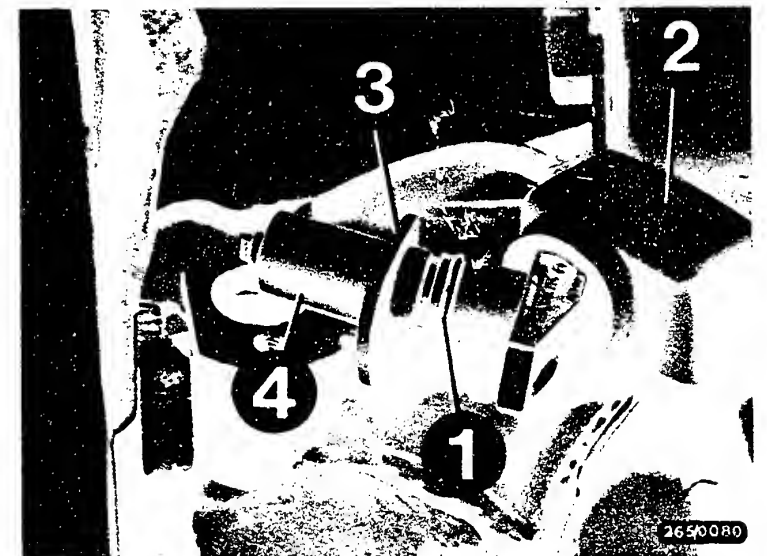
Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Correct shim ring fitted?
Be sure to check thickness of shim ring with micrometer screw.
- Press wheel-speed sensor into mounting hole. Do not hit. Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve properly.
- Run cable under rear seat and connect to wiring harness.
- Fully test ABS with tester.



Measuring the shim ring with micrometer screw

- 1 = O-ring
- 2 = Rubber sleeve
- 3 = Shim ring
- 4 = Wheel-speed sensor housing



F7

Test with ABS tester
BMW 7 series



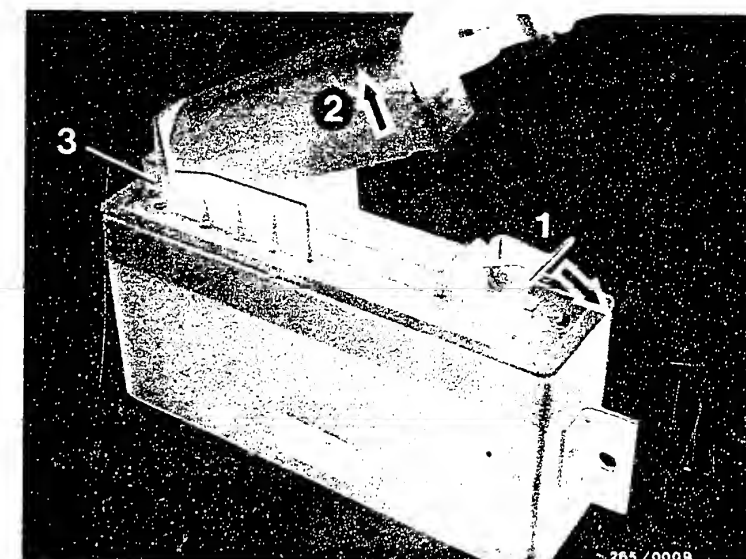
F8

Test with ABS tester
BMW 7 series



TEST STEP 17

Operation:		Reading:	Testing:
Program-selector switch position	13	Digital display unit: 8.85 ... 9.15 V	Component: Controller
Illuminated key lights up, press key	●	For generation 2B (as of mid 1983): 4.75 ... 5.25 V	Operation: Internal supply voltage
Operation in vehicle: Switch on ignition		If reading OK, continue testing with next test step.	Malfunction: Voltage less than 8.85 V/4.75 V or greater than 9.15 V/5.25 V (for generation 2B)



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

Trouble-shooting:

Replace controller (switch off ignition).

Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that multiple plug locks into spring.

Continued on F11/F12

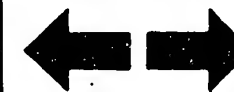
F9

Test with ABS tester
BMW 7 series



F10

Test with ABS tester
BMW 7 series



TEST STEP 18

Operation:

Program-selector switch position

14

Reading:

Digital display unit must indicate

0.4 ... 1.5 V

Testing:

Component:

Hydraulic modulator and indicator lamp

Operation:

Diode in forward direction

Malfunction:

Reading less than 0.4 V or greater than 1.5 V.
Indicator lamp does not light up.

Operation in vehicle:

Switch on ignition

Check:

ABS indicator lamp in vehicle must light up.

If reading OK, continue testing with next test step.

Trouble-shooting (switch off ignition)

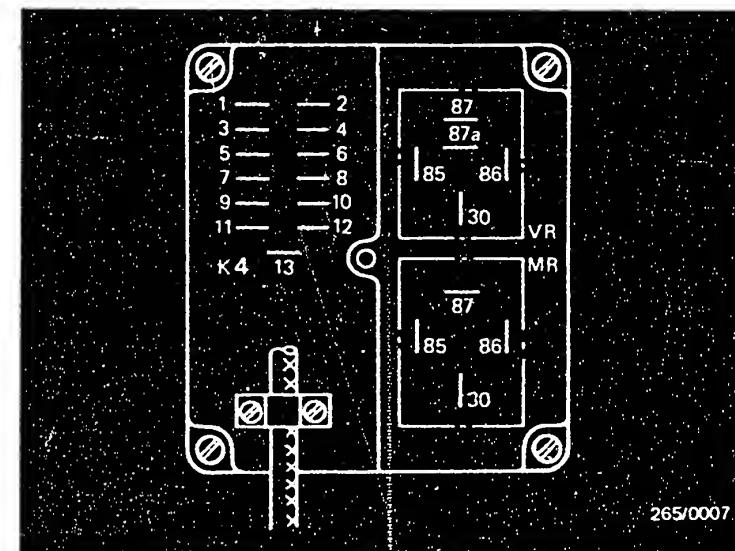
Indicator lamp does not light up:

- Indicator lamp defective.
- Open circuit in cable to ignition lock.
- Check for open circuit in cables (29) and (43) from multiple plug K1/term. 29 to hydraulic modulator K3/term.10.
- Check diode in forward and reverse directions with test lamp between K4/term.10 and K4/term.12.

Reading outside tolerance:

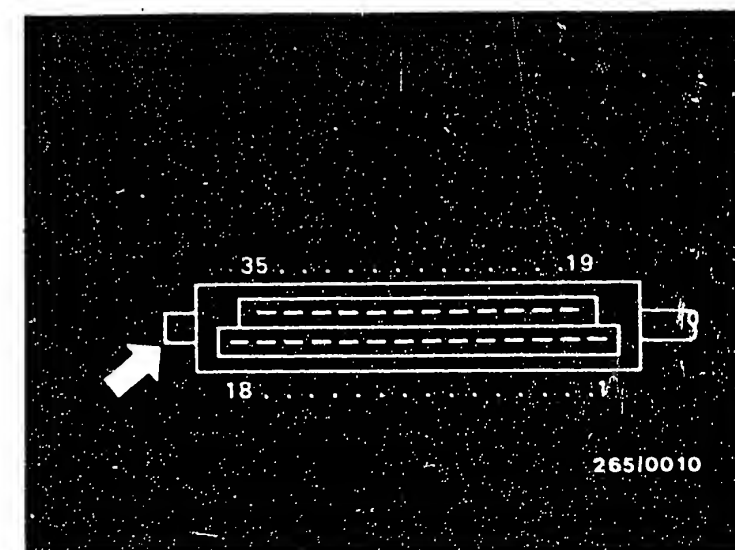
- Check diode in forward and reverse directions with test lamp between K4/term.10 and K4/term.12.
- Check for open circuit in cable (29) between multiple plug K1/term.29 and ABS indicator lamp.
- Check for voltage drop at plug-in connections on indicator lamp, K3/term.10, K4/term.10, K3/term.8, K4/term.8 as well as ground cable and valve relay plug-in connections.
If diode defective, replace hydraulic modulator.

Continued on F13/F14



Top view of plug-in plate on hydraulic modulator
Position of terminals
VR = Valve relay
MR = Return-pump relay
K4 = Wiring-harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical coding



F11

Test with ABS tester
BMW 7 series



F12

Test with ABS tester
BMW 7 series

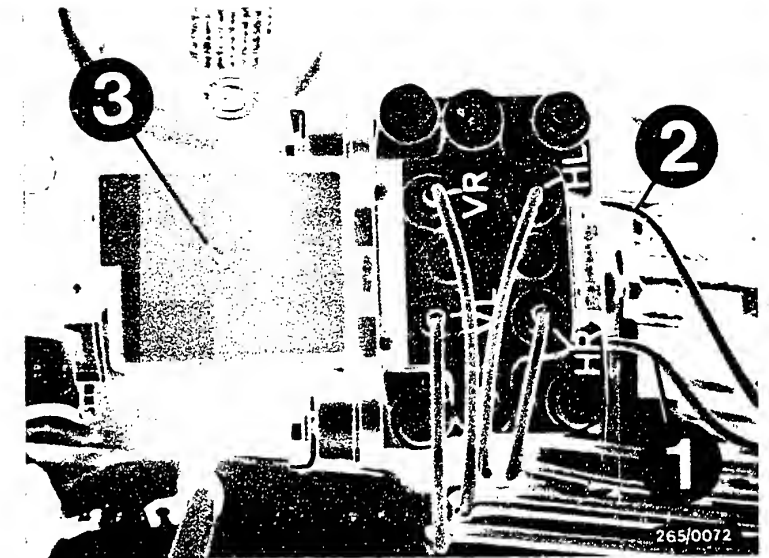


Trouble-shooting for TEST STEP 18 (continued)

Removing the hydraulic modulator

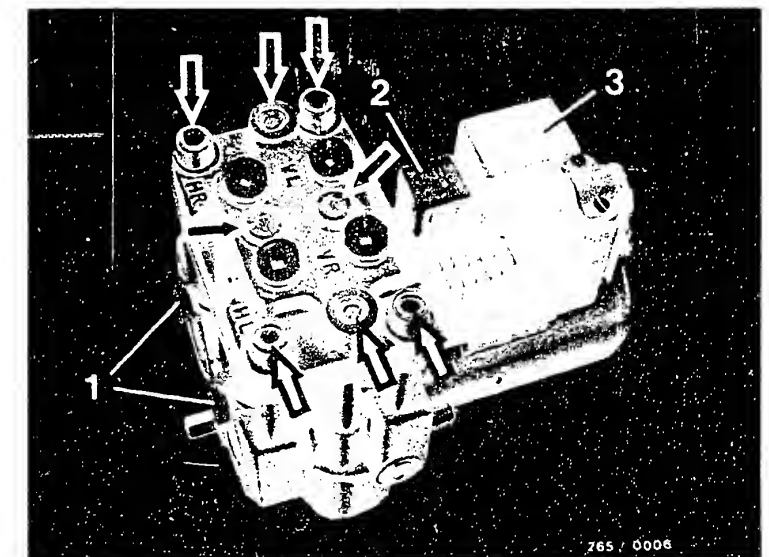
- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake-line connections, it is not permissible to loosen any screws on the hydraulic modulator. In particular the hexagon-socket-head cap screws (bottom picture - arrows) may under no circumstances be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12...16 Nm) or replace, or replace the hydraulic modulator.

Continued on F15/F16



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay



F13

Test with ABS tester
BMW 7 series



F14

Test with ABS tester
BMW 7 series

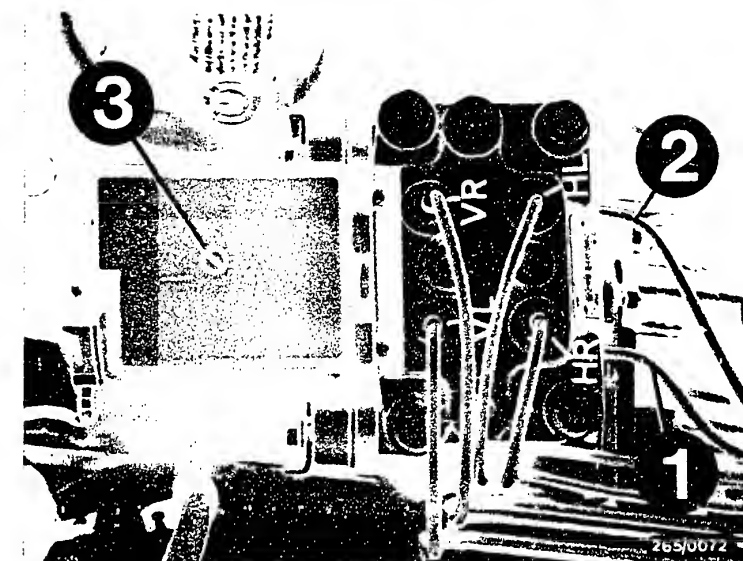


Trouble-shooting for TEST STEP 18 (continued)

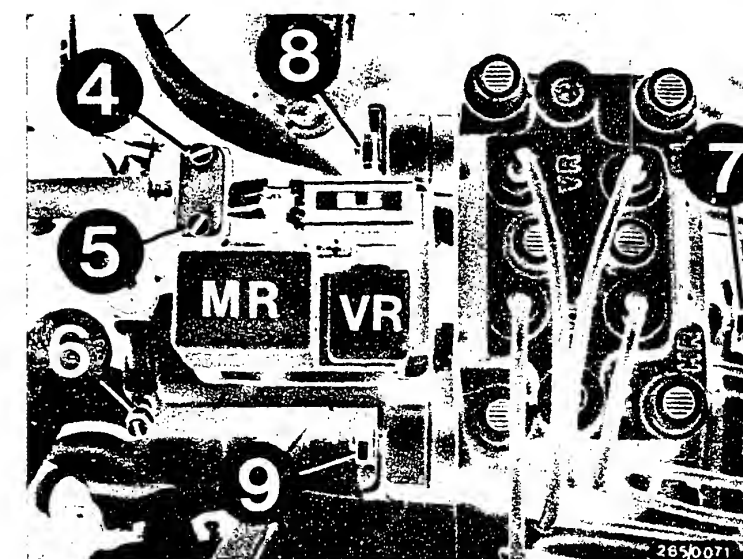
- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. FL of hydraulic modulator must be connected to the front left wheel brake cylinder).
- Markings on hydraulic modulator
 - VL = Connection for brake line front left (wheel brake cylinder)
 - VR = Connection for brake line front right (wheel brake cylinder)
 - HR = Connection for brake line rear right (wheel brake cylinder)
 - HL = Connection for brake line rear left (wheel brake cylinder)
- Use only the specified double-end flare nut wrench 9x11 mm for loosening and tightening the brake lines.
- Mark brake lines and remove from hydraulic modulator.
- Catch the brake fluid and do not bring it into contact with your skin or clothing or with paintwork.
- Immediately seal the brake lines and connections with dummy plugs.
- Disconnect ground cable (6) from pump motor.
- Loosen fastening screw and remove cover.
- Loosen bracket (4, 5) and remove plug.
- Loosen hexagon nuts from holder (7,8,9) and remove hydraulic modulator.

Installation

- Mount hydraulic modulator in the holder and fasten with the hexagon nuts.
- Connect ground cable to pump motor. Plug on 13-pin plug and fasten with the bracket.
- Fasten cover on the hydraulic modulator with the screw.
- Connect the brake lines to the hydraulic modulator in accordance with the markings.
- Observe the tightening torque for the brake-line connections on the hydraulic modulator: 12...16 Nm.
- Bleed the brake system and check for leaks.
- Fully test the ABS with the tester.



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid
- 4,5 = Screws for wiring harness strain relief
- 6 = Ground terminal for pump motor
- 7,8,9 = Mounting points for hydraulic modulator
- MR = Return-pump relay
- VR = Valve relay

**F15**

Test with ABS tester
BMW 7 series

**F16**

Test with ABS tester
BMW 7 series



TEST STEP 19

Operation:

Program-selector switch position

15

Reading:

Digital display unit must indicate

2.5 ... 8.5 V

Note:

ABS indicator lamp slightly dimmer. Valve relay switches.

If reading OK, continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

Diode in reverse direction

Malfunction:

Reading less than 2.5 V or greater than 8.5 V

Operation in vehicle:

Switch on ignition

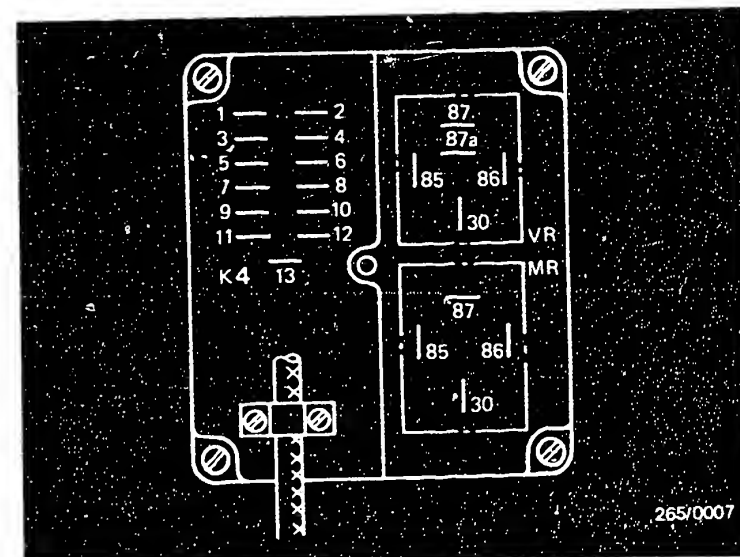
Trouble-shooting (switch off ignition):

Reading outside tolerance:

Check diode in forward and reverse directions with test lamp between K4/term.10 and K4/term.12.

If diode defective, replace hydraulic modulator.

Continued on F19/F20



Top view of plug-in plate on hydraulic modulator

Position of terminals

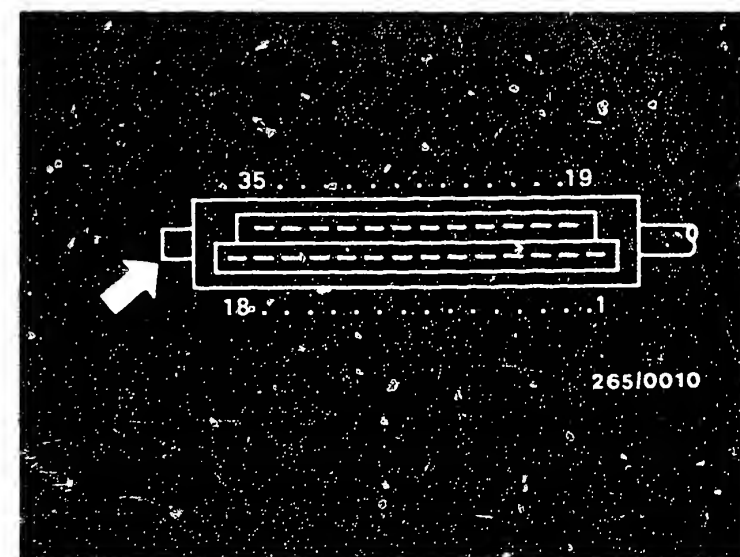
VR = Valve relay

MR = Return-pump relay

K4 = Wiring-harness plug

Top view of multiple plug (35-pin) with terminal numbers

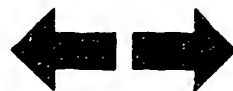
Arrow = Lug with mechanical coding



F17

Test with ABS tester

BMW 7 series



F18

Test with ABS tester

BMW 7 series

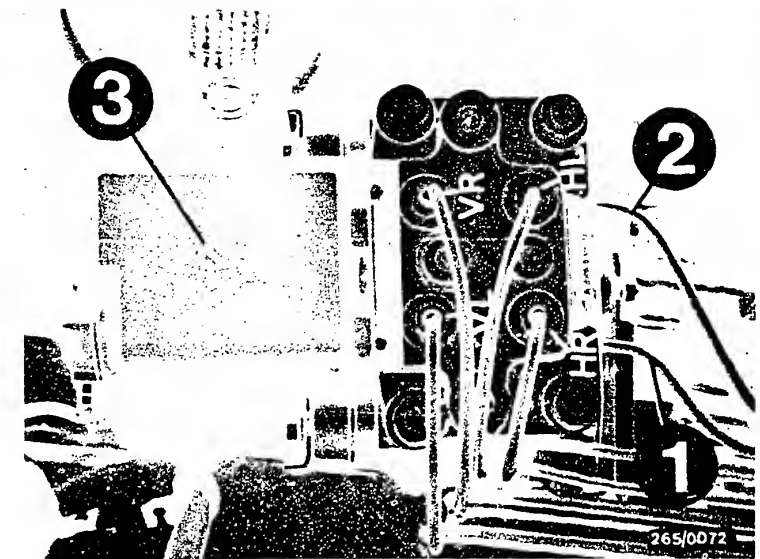


Trouble-shooting for TEST STEP 19 (continued)

Removing the hydraulic modulator

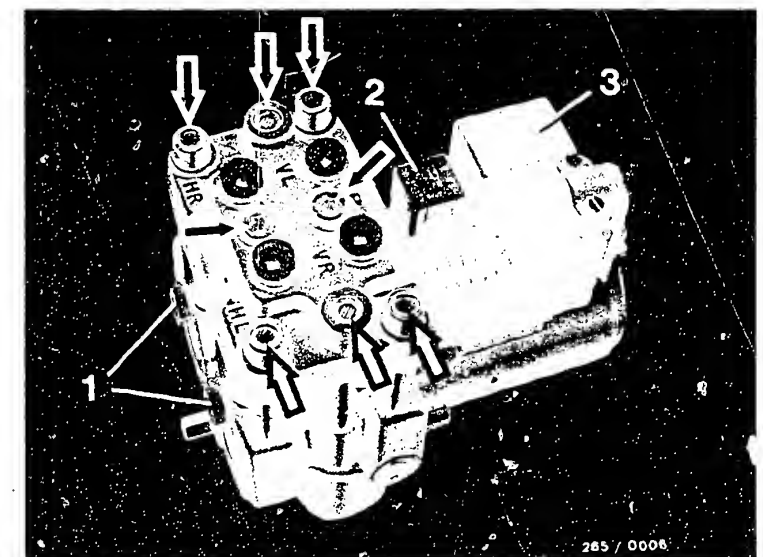
- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake-line connections, it is not permissible to loosen any screws on the hydraulic modulator. In particular the hexagon-socket-head cap screws (bottom picture - arrows) may under no circumstances be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12...16 Nm) or replace, or replace the hydraulic modulator.

Continued on F21/F22



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay



F19

Test with ABS tester
BMW 7 series



F20

Test with ABS tester
BMW 7 series

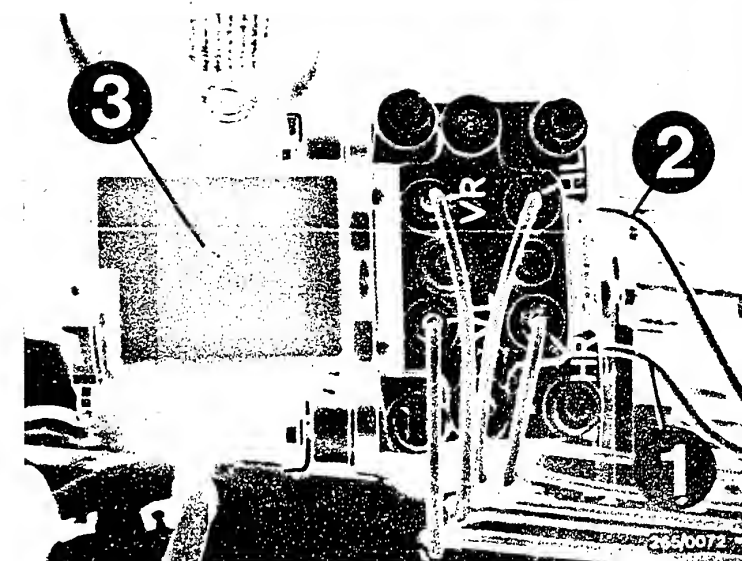


Trouble-shooting for TEST STEP 19 (continued)

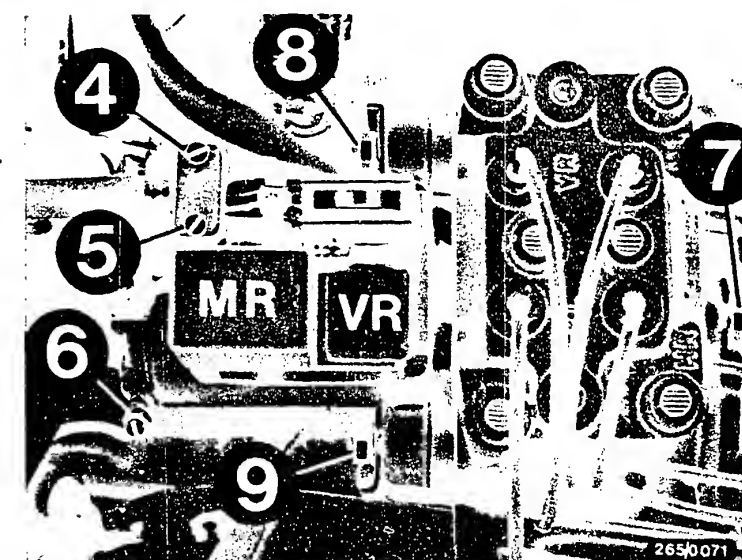
- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. FL of hydraulic modulator must be connected to the front left wheel brake cylinder).
- Markings on hydraulic modulator
 - VL = Connection for brake line front left (wheel brake cylinder)
 - VR = Connection for brake line front right (wheel brake cylinder)
 - HR = Connection for brake line rear right (wheel brake cylinder)
 - HL = Connection for brake line rear left (wheel brake cylinder)
- Use only the specified double-end flare nut wrench 9x11 mm for loosening and tightening the brake lines.
- Mark brake lines and remove from hydraulic modulator.
- Catch the brake fluid and do not bring it into contact with your skin or clothing or with paintwork.
- Immediately seal the brake lines and connections with dummy plugs.
- Disconnect ground cable (6) from pump motor.
- Loosen fastening screw and remove cover.
- Loosen bracket and remove plug.
- Loosen hexagon nuts from holder (7,8,9) and remove hydraulic modulator.

Installation

- Mount hydraulic modulator in the holder and fasten with the hexagon nuts.
- Connect ground cable to pump motor. Plug on 13-pin plug and fasten with the bracket.
- Fasten cover on the hydraulic modulator with the screw.
- Connect the brake lines to the hydraulic modulator in accordance with the markings.
- Observe the tightening torque for the brake-line connections on the hydraulic modulator: 12...16 Nm.
- Bleed the brake system and check for leaks.
- Fully test the ABS with the tester.



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid
- 4,5 = Screws for wiring harness strain relief
- 6 = Ground terminal for pump motor
- 7,8,9 = Mounting points for hydraulic modulator
- MR = Return-pump relay
- VR = Valve relay

**F21**

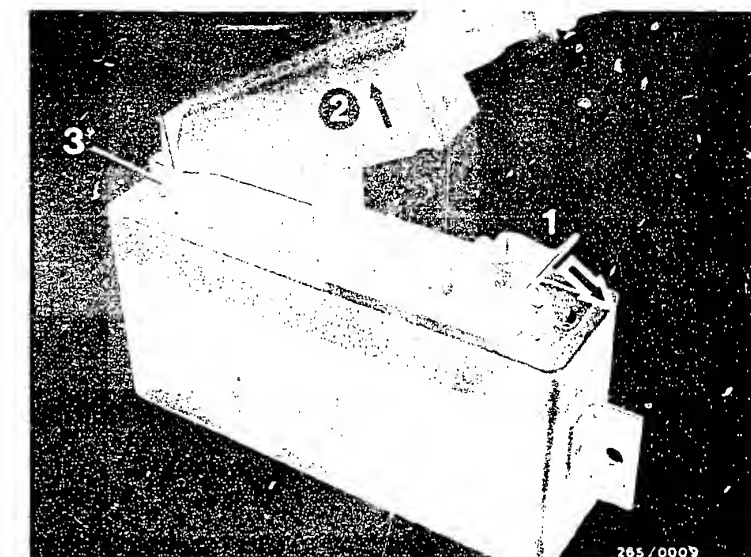
Test with ABS tester
BMW 7 series

**F22**

Test with ABS tester
BMW 7 series



TEST STEP 20			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	16	Watch ABS indicator lamp in vehicle: After pressing the illuminated key the lamp must <u>go out</u> within 3 seconds. If reading OK, continue testing with <u>next test step</u> .	<u>Component:</u> Controller
Illuminated key lights up. Press key for at least 3 seconds.	●		<u>Operation:</u> BITE* triggering
<u>Operation in vehicle:</u> Switch off ignition			<u>Malfunction:</u> Indicator lamp does not go out



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

*BITE = Built-in test circuit

F23

Test with ABS tester
BMW 7 series

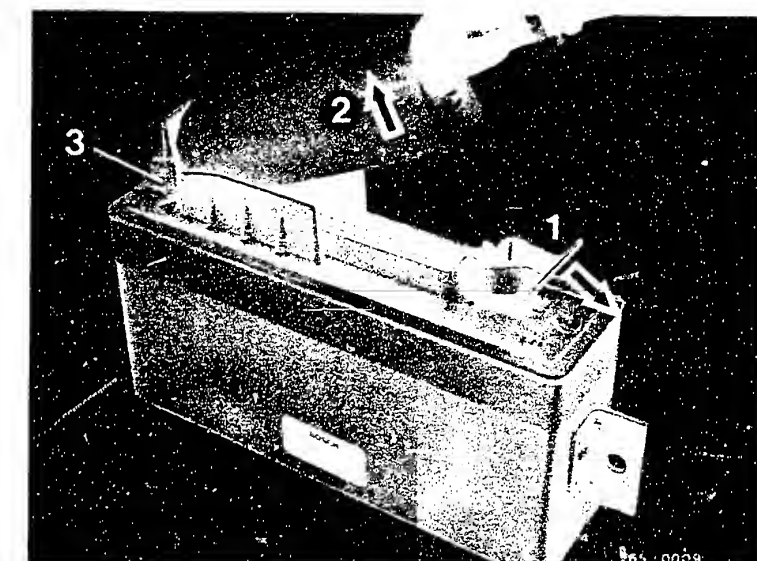


F24

Test with ABS tester
BMW 7 series



TEST STEP 21			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	17	Watch ABS indicator lamp in vehicle: Lamp <u>must</u> light up as long as the key is pressed. If reading OK, con- tinue testing with <u>next test step.</u>	<u>Component:</u> Controller
Illuminated key lights up. Press key for at least 3 seconds.	●		<u>Operation:</u> BITE* program with fault simulation
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Indicator lamp goes out.



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

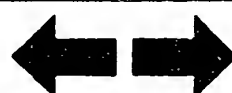
Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

*BITE = Built-in test circuit

G1

Test with ABS tester
BMW 7 series

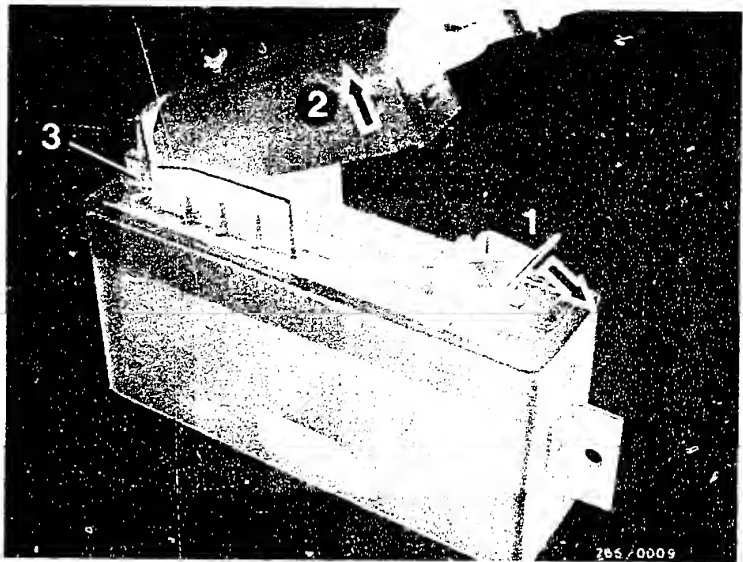


G2

Test with ABS tester
BMW 7 series



TEST STEP 22			
Operation:		Reading:	Testing:
Program-selector switch position	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	<u>Component:</u> Controller
Press key FL	●		<u>Operation:</u> Valve current. Pressure holding front left
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		<u>Malfunction:</u> Current less than 1.9 A/1.95 A or greater than 2.3 A/2.25 A
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Pump motor starts up. If reading OK, continue testing with next test step.	



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

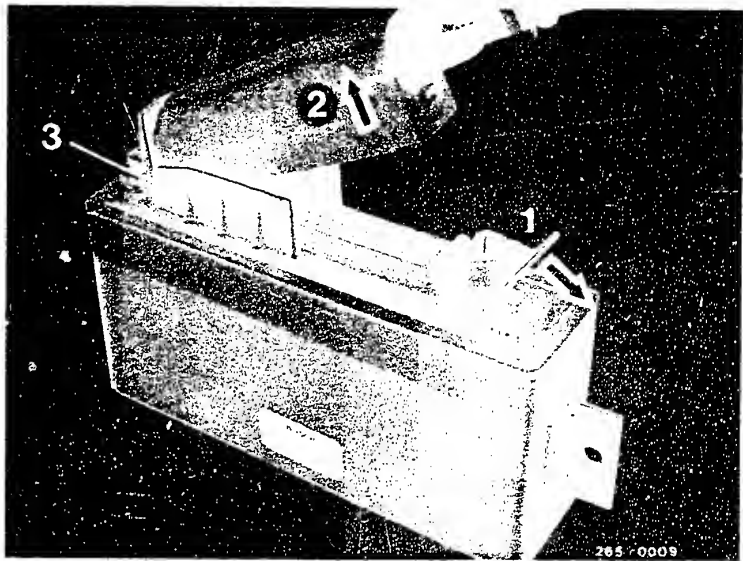
Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

TEST STEP 23			
Operation:		Reading:	Testing:
Program-selector switch position	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	<u>Component:</u> Controller
Press key FR	●		<u>Operation:</u> Valve current. Pressure holding front right
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		<u>Malfunction:</u> Current less than 1.9A/1.95 A or greater than 2.3A/2.25 A
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Pump motor starts up. If reading OK, continue testing with <u>next test step.</u>	



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G5

Test with ABS tester
BMW 7 series

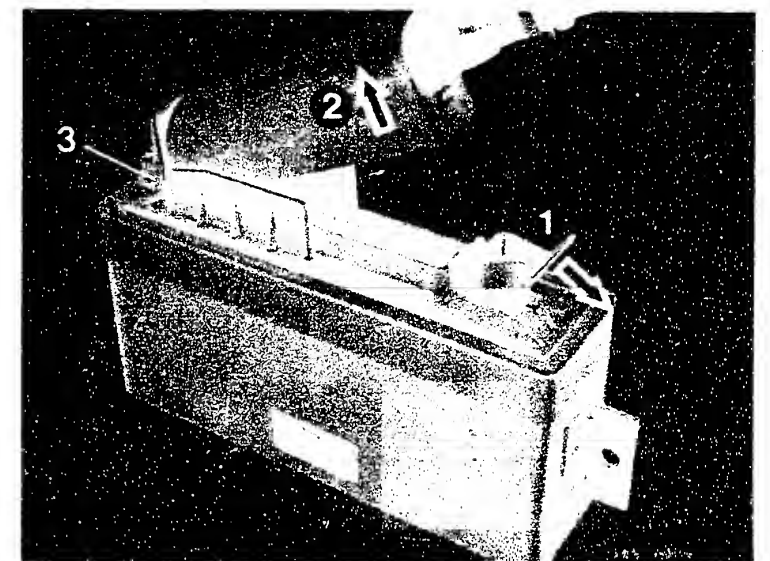


G6

Test with ABS tester
BMW 7 series



TEST STEP 24			
Operation:		Reading:	Testing:
Program-selector switch position	18	Digital display unit must indicate 1.9 ... 2.3 A	Component: Controller
Press key RL	●		
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		Operation: Valve current. Pressure holding rear left
Operation in vehicle: Switch on ignition		Note: Pump motor starts up. If reading OK, continue testing with next test step.	Malfunction: Current less than 1.9 A/1.95 A or greater than 2.3 A/2.25 A



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

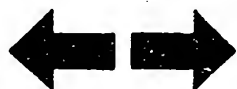
1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G7

Test with ABS tester
BMW 7 series

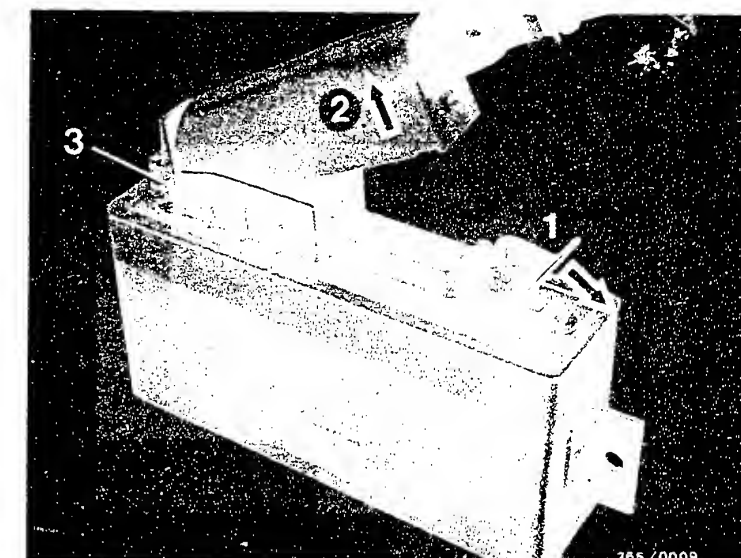


G8

Test with ABS tester
BMW 7 series



TEST STEP 25			
Operation:		Reading:	Testing:
Program-selector switch position	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	<u>Component:</u> Controller
Press key RR	●		<u>Operation:</u> Valve current. Pressure holding rear right
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		<u>Malfunction:</u> Current less than 1.9 A/1.95 A or greater than 2.3 A/2.25 A
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Pump motor starts up. If reading OK, continue testing with next test step.	



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

Trouble-shooting:

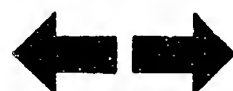
1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G9

Test with ABS tester
BMW 7 series

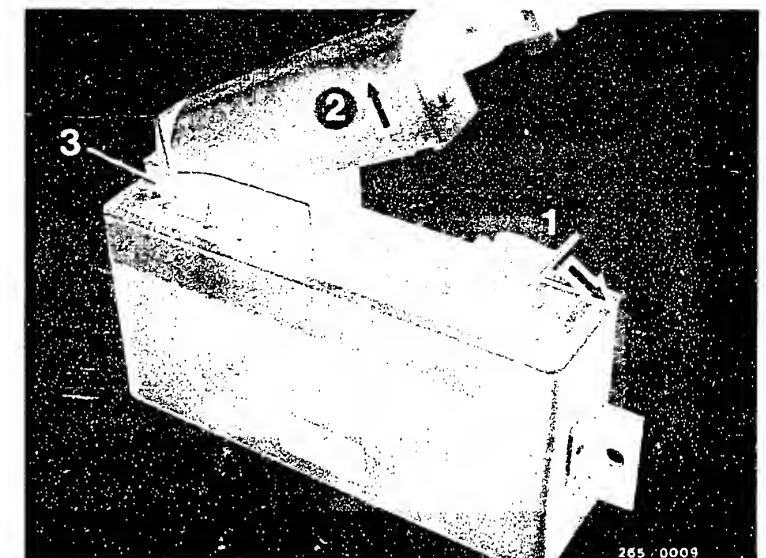


G10

Test with ABS tester
BMW 7 series



TEST STEP 26			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4.5...5.7 A.</u>	<u>Component:</u> Controller
Press key FL	●		<u>Operation:</u> Valve current, pressure reduction front left
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●	For generation 2B (as of mid 1983): <u>4.5...6.1 A</u> <u>Note:</u> Pump motor starts up.	<u>Malfunction:</u> Current less than 4.5 A or greater than 5.7 A/6.1 A
<u>Operation in vehicle:</u> Switch on ignition		If reading OK, continue testing with next test step.	



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G11

Test with ABS tester
BMW 7 series

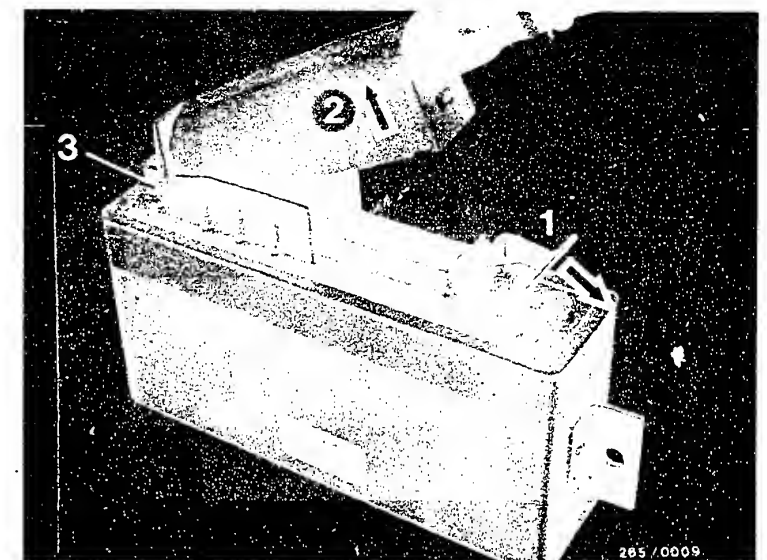


G12

Test with ABS tester
BMW 7 series



TEST STEP 27			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4.5...5.7 A.</u> For generation 2B (as of mid 1983): <u>4.5...6.1 A</u> <u>Note:</u> Pump motor starts up. If reading OK, continue testing with next test step.	<u>Component:</u> Controller
Press key FR	●		<u>Operation:</u> Valve current, pressure reduction front right
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●		<u>Malfunction:</u> Current less than 4.5 A or greater than 5.7 A/6.1 A
<u>Operation in vehicle:</u> Switch on ignition			



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds. If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G13

Test with ABS tester
BMW 7 series

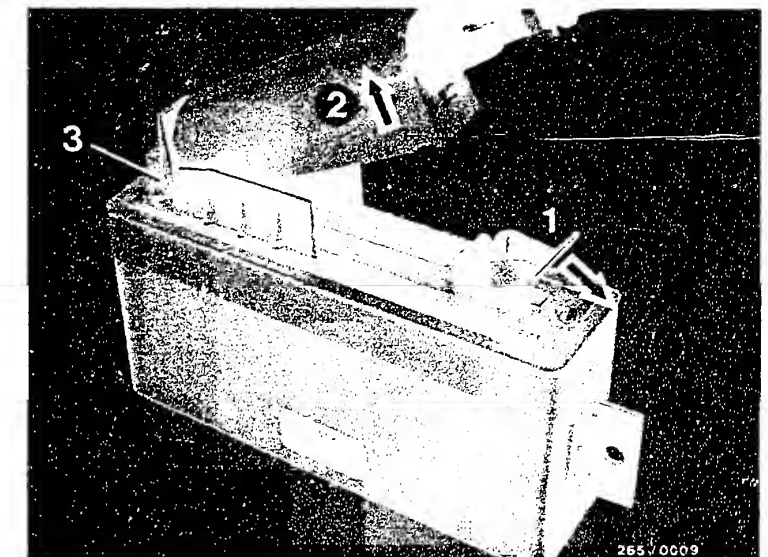


G14

Test with ABS tester
BMW 7 series



TEST STEP 28			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4.5...5.7 A.</u> For generation 2B (as of mid 1983): <u>4.5...6.1 A</u> <u>Note:</u> Pump motor starts up. If reading OK, continue testing with <u>next test step.</u>	<u>Component:</u> Controller
Press key RL	●		<u>Operation:</u> Valve current, pressure reduction rear left
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●		<u>Malfunction:</u> Current less than 4.5 A or greater than 5.7 A/6.1 A
<u>Operation in vehicle:</u> Switch on ignition			



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

G 15

Test with ABS tester
BMW 7 series

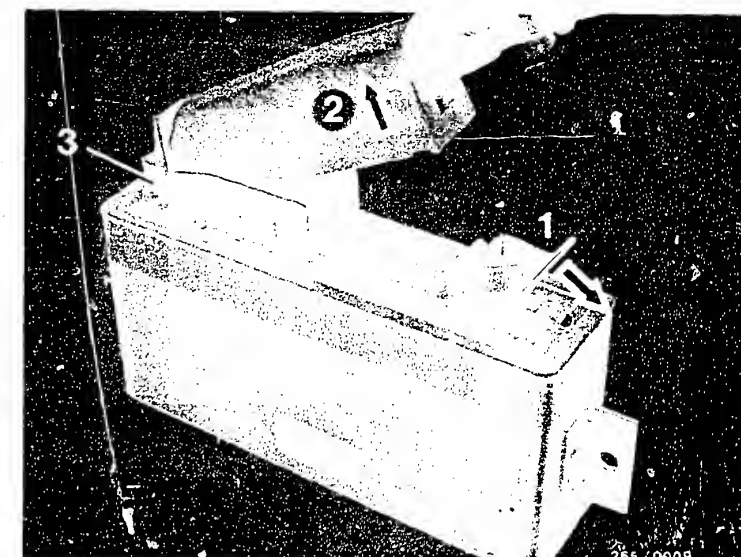


G 16

Test with ABS tester
BMW 7 series



TEST STEP 29			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	19	Digital display unit must indicate <u>4.5...5.7 A.</u>	<u>Component:</u> Controller
Press key RR	●	For generation 2B (as of mid 1983): <u>4.5...6.1 A</u>	
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●	<u>Note:</u> Pump motor starts up. If reading OK, continue testing with next test step.	<u>Operation:</u> Valve current, pressure reduction rear right
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Current less than 4.5 A or greater than 5.7 A/6.1 A



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

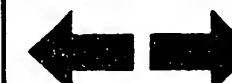
G17

Test with ABS tester
BMW 7 series



G18

Test with ABS tester
BMW 7 series



A dynamic brake analyzer (DBA) is necessary for program-selector switch positions 20, 21, 22 and 23.

Caution:

Do not drive with the tester connected.

Do not use a brake-pedal actuating device for setting the brake-pedal force.

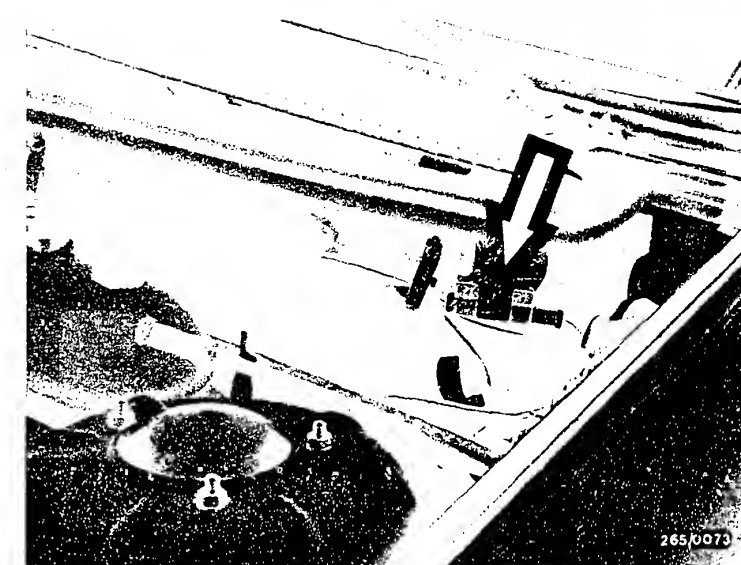
Carry out program-selector switch position 23 first since it is assumed in the following test steps that the wheel-speed sensors are in proper working condition. In the case of repeat tests and a change of channel wait at least 20 seconds (internal tester program must have run).

Make absolutely sure that the sequence of operations is followed.

Start testing with the front axle.

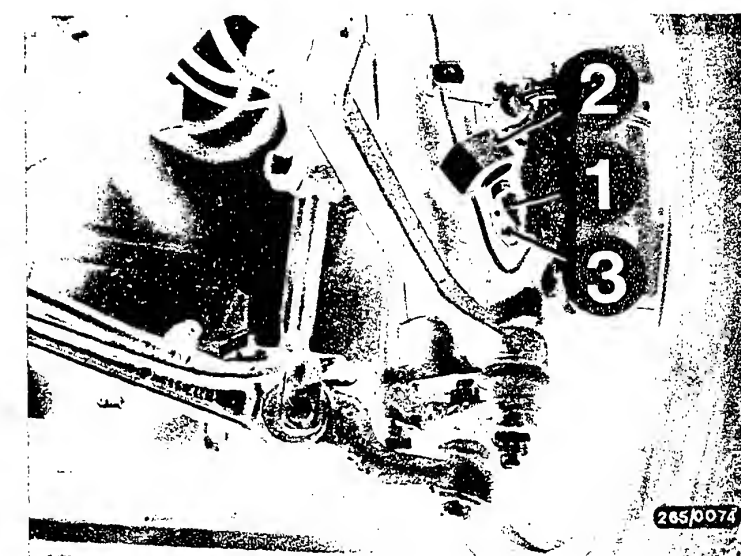


TEST STEP 30			
Operation:		Reading:	Testing:
Program-selector switch position	23	Digital display unit must indicate <u>1.9 ... 19</u>	Component: Wheel-speed sensor <u>front left</u>
Additional operations:		In case of fluctuating readings, the lowest reading is valid. Note: If reading is 1.9, check air gap.	Operation: Signal and mixing up of connecting cables
<ul style="list-style-type: none"> Drive front wheels of vehicle onto dynamic brake analyzer Pull on the handbrake. <p><u>Caution!</u> In vehicles with automatic transmission make sure that selector lever is not in parking position (P).</p> <ul style="list-style-type: none"> Switch on the ignition. Select wheel FL with key FL. Switch on <u>Left-hand brake</u> roller. Make reading. 		If reading OK, continue testing with <u>next test step.</u>	Malfunction: Reading less than 1.9 or greater than 19



Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



Trouble-shooting: (switch off ignition)

A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h)

Continued on G22/G23

G20

Test with ABS tester
BMW 7 series



G21

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 30 (continued)

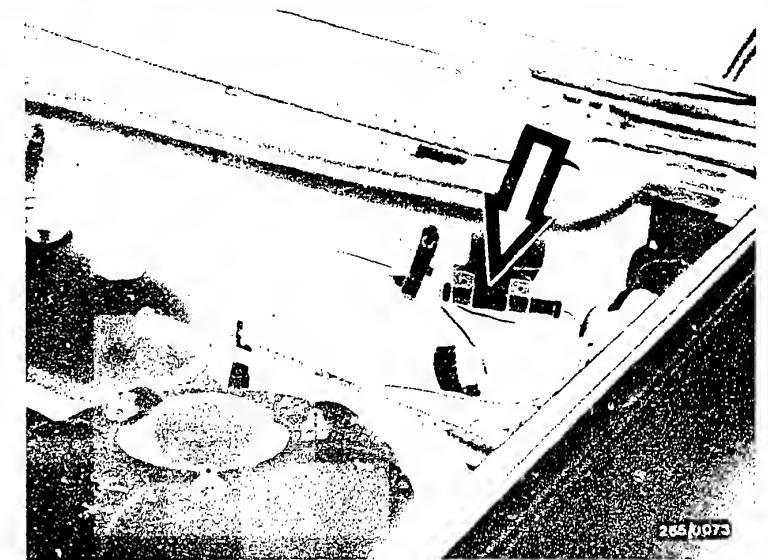
Reading of 0 or less than 1.9

- Wheel-speed sensors reversed? Check assignment: Wheel-speed sensors must correspond to the specified wheel and controller input. If necessary, compare with circuit diagram.
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel-bearing play.
- Replace wheel-speed sensor.

Remove wheel-speed sensors on front axle

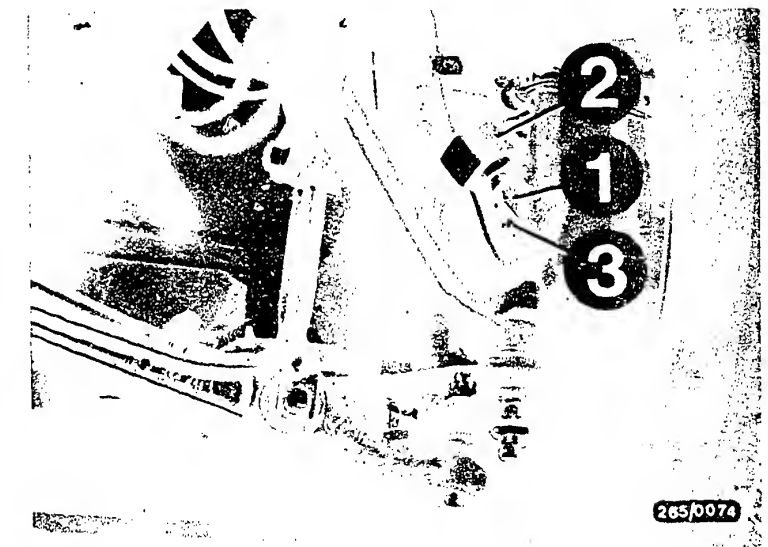
- Undo plug connector (top picture - arrow) in engine compartment.
- Installation positions of plug connectors:
In engine compartment on left and right on firewall.
- Take plug connector out of holder and undo.
- Loosen cable mountings and push back rubber sleeve over wheel-speed sensor.
- Loosen fastening screw (3) and pull out wheel-speed sensor. Do not use force.

Continued on H1/H2



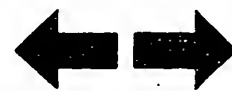
Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



G22

Test with ABS tester
BMW 7 series



G23

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 30 (continued)

Installing wheel-speed sensors on front axle

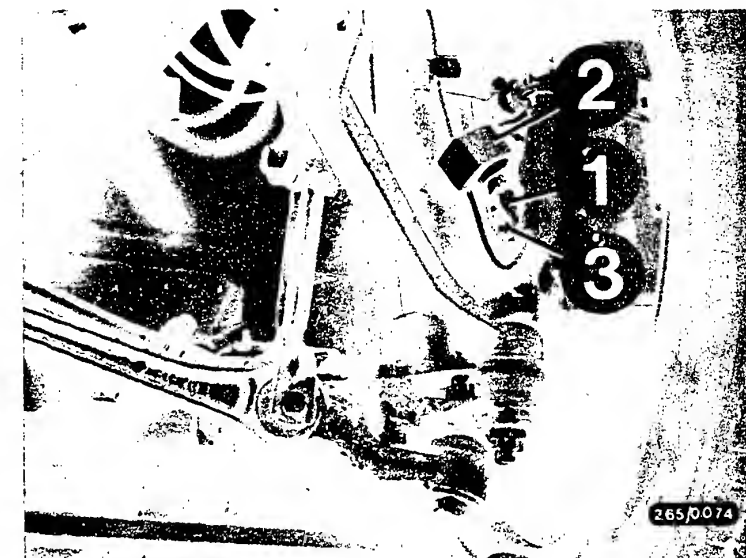
Note: The wheel-speed sensors for the front wheels are installed without shim rings.

- Check O-ring and rubber sleeve for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Press wheel-speed sensor into mounting hole. Do not hit.
Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve correctly.
- Pull cable up into engine compartment and connect to ABS wiring harness by means of the 2-pin plug connector.
- Fully test the ABS with the tester.



- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw

H1

Test with ABS tester
BMW 7 series



H2

Test with ABS tester
BMW 7 series



TEST STEP 31

Operation:

Program-selector switch position

23

Additional operations:

- Drive front wheels of vehicle onto dynamic brake analyzer
- Pull on the handbrake.

Caution:

In vehicles with automatic transmission make sure that selector lever is not in parking position (P).

- Switch on the ignition.
- Select wheel FR with key FR.
- Switch on right-hand brake roller only.
- Make reading.

Reading:

Digital display unit must indicate

1.9 ... 19

In case of fluctuating readings, the lowest reading is valid.

Note:

If reading is 1.9, check air gap.

If reading OK, continue testing with next test step.

Testing:

Component:

Wheel-speed sensor front right

Operation:

Signal and mixing up of connecting cables

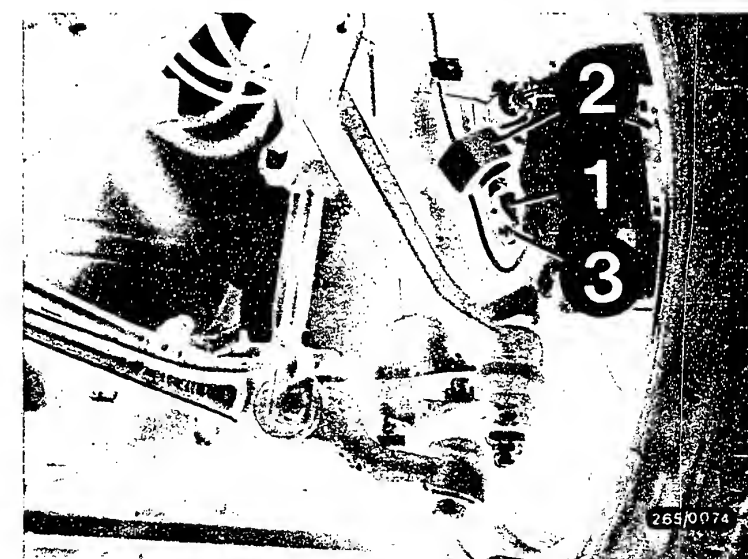
Malfunction:

Reading less than 1.9 or greater than 19



Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



Trouble-shooting: (switch off ignition)

A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h)

Continued on H5/H6

H3

Test with ABS tester
BMW 7 series



H4

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 31 (continued)

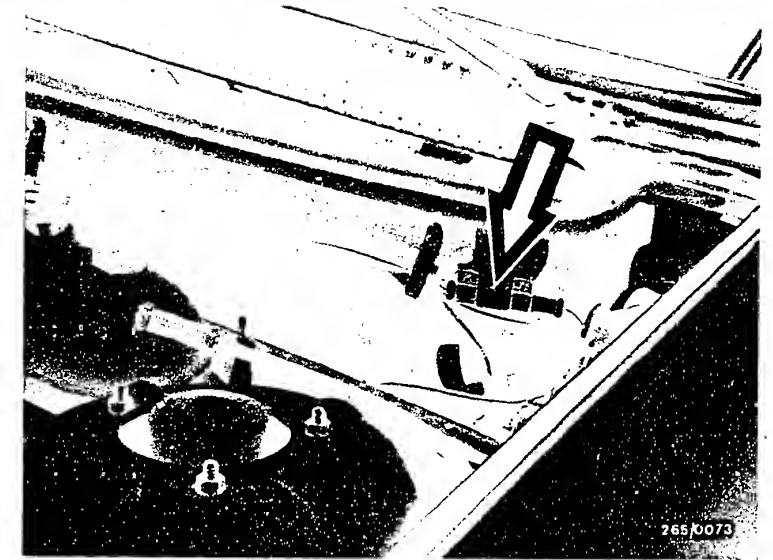
Reading of 0 or less than 1.9

- Wheel-speed sensors reversed? Check assignment: Wheel-speed sensors must correspond to the specified wheel and controller input. If necessary, compare with circuit diagram.
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel-bearing play.
- Replace wheel-speed sensor.

Remove wheel-speed sensors on front axle

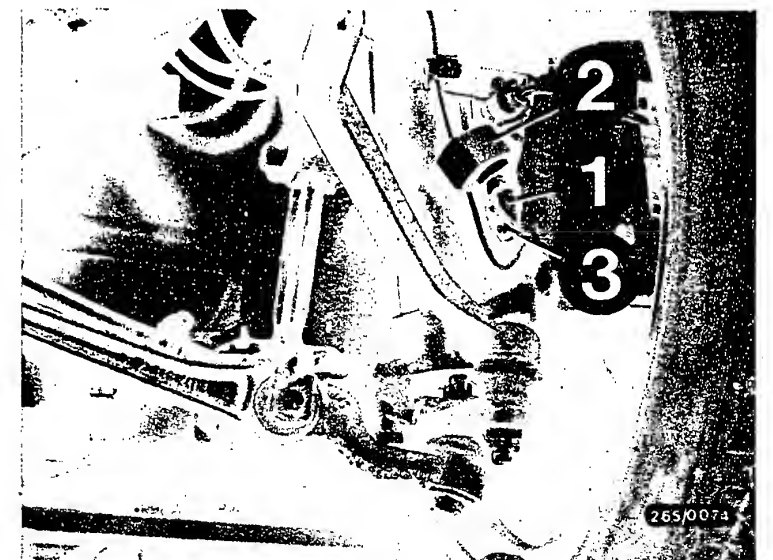
- Undo plug connector (top picture - arrow) in engine compartment.
- Installation positions of plug connectors:
In engine compartment on left and right on firewall.
- Take plug connector out of holder and undo.
- Loosen cable mountings and push back rubber sleeve over wheel-speed sensor.
- Loosen fastening screw (3) and pull out wheel-speed sensor. Do not use force.

Continued on H7/H8



Arrow = Wheel-speed sensor plug connector in engine compartment

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw



H5

Test with ABS tester
BMW 7 series



H6

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 31 (continued)

Installing wheel-speed sensors on front axle

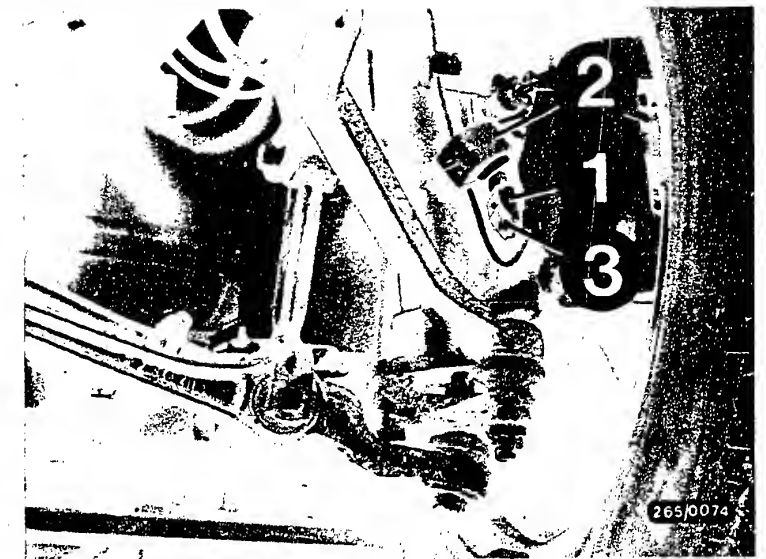
Note: The wheel-speed sensors for the front wheels are installed without shim rings.

- Check O-ring and rubber sleeve for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Press wheel-speed sensor into mounting hole. Do not hit.
Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve correctly.
- Pull cable up into engine compartment and connect to ABS wiring harness by means of the 2-pin plug connector.
- Fully test the ABS with the tester.



- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw

H7

Test with ABS tester

BMW 7 series



H8

Test with ABS tester

BMW 7 series



TEST STEP 32

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Select test step 20 and select wheel FL with key FL
- Switch on left-hand brake roller.
- Press brake pedal until the braking force reading on the dynamic brake analyzer is 2000 N (200 kgf).
- Press illuminated key.
- There must be a pressure reduction on the corresponding wheel (front left).
- Release the brake pedal and illuminated key (keep to the sequence of operations so that vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to a value

below 1100 N (110 kgf)

If reading OK, continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat test.
Wait at least 20 sec. between tests.
- Brake lines mixed up on hydraulic modulator?
Follow markings.
- Check assignment of brake roller to keys FR and FL once again.

Testing:

Component:

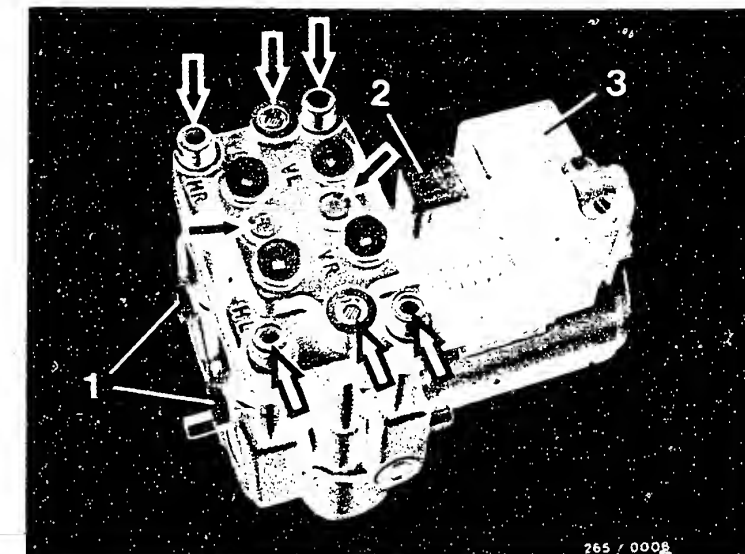
Hydraulic modulator, front axle

Operation:

Mixing up of brake lines

Malfunction:

Reading does not drop.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay
- VL= Connection for brake line front left (wheel brake cyl.)
- VR= Connection for brake line front right (wheel brake cyl.)
- HR= Connection for brake line rear right (wheel brake cyl.)
- HL= Connection for brake line rear left (wheel brake cyl.)

Caution!

Under no circumstances may the hexagon-socket-head cap screws (arrows) be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.

Danger!

H9

Test with ABS tester

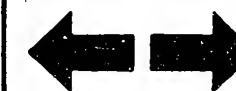
BMW 7 series



H10

Test with ABS tester

BMW 7 series



TEST STEP 33

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Switch off left-hand brake roller.
- Switch on right-hand brake roller.
- Select wheel FR with key FR.
- Using brake pedal, produce braking force of 2000 N (200 kgf).
- Press illuminated key.
- There must be a pressure reduction on the corresponding wheel (front right).
- Release brake pedal and illuminated key.
(Follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Right-hand reading drops to a value

below 1100 N (110 kgf).

If reading OK, continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat test.
Wait at least 20 sec. between tests.
- Brake lines mixed up on hydraulic modulator?
Follow markings.
- Check assignment of brake roller to keys FR and FL once again.

Testing:

Component:

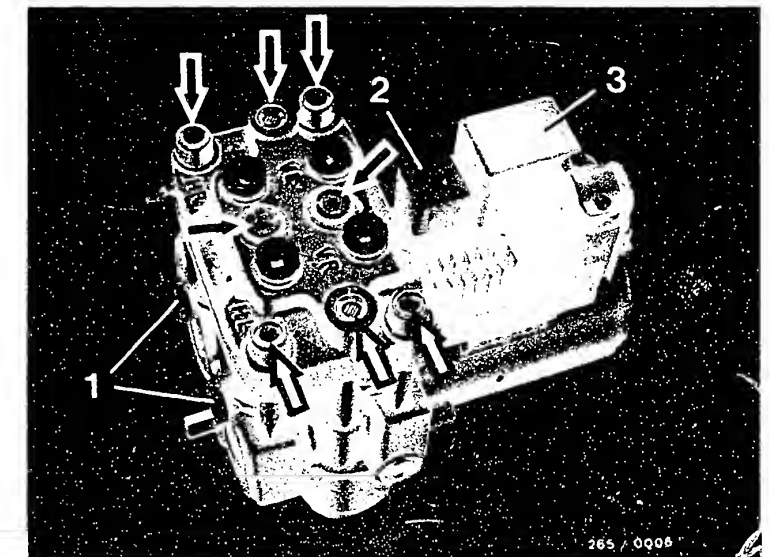
Hydraulic modulator, front axle

Operation:

Mixing up of brake lines

Malfunction:

Reading does not drop.



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay
- VL= Connection for brake line front left (wheel brake cyl.)
- VR= Connection for brake line front right (wheel brake cyl.)
- HR= Connection for brake line rear right (wheel brake cyl.)
- HL= Connection for brake line rear left (wheel brake cyl.)

Caution!

Under no circumstances may the hexagon-socket-head cap screws (arrows) be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.

Danger!

H11

Test with ABS tester
BMW 7 series



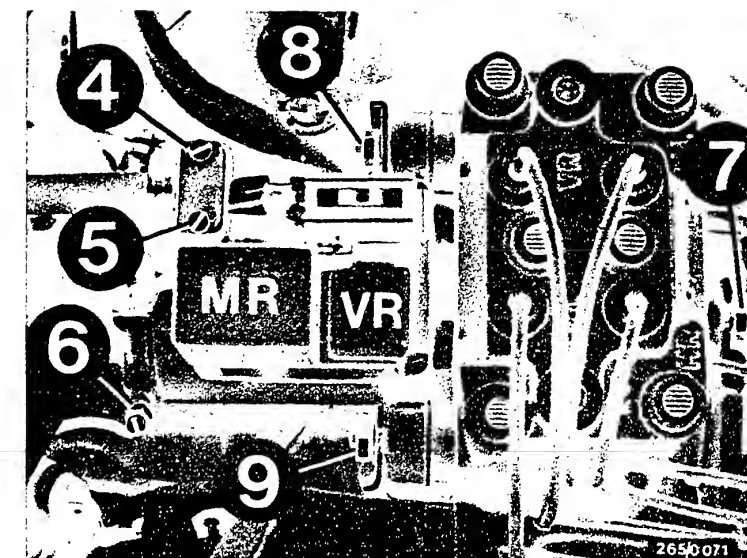
H12

Test with ABS tester
BMW 7 series



TEST STEP 34		Reading:	Testing:
Operation:			
Program-selector switch position	20	Instruments on dynamic brake analyzer:	Component:
<u>Additional operations:</u> <ul style="list-style-type: none"> Let the engine run. Switch on <u>left-hand</u> and <u>right-hand</u> brake rollers. Select wheel FL with key FL. Depress brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the <u>left-hand</u> side. Brake pedal force must not be changed throughout the entire testing procedure. <ul style="list-style-type: none"> Right-hand reading may differ by no more than 500 N (50 kgf) from the left-hand reading. Press illuminated key until test is completed (approx. 10 seconds). Read off <u>left-hand</u> reading. Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers). 		Left-hand reading drops to a value	Hydraulic modulator
		below 1100 N (110 kgf)	Operation:
		If reading OK, continue testing with next test step.	Pressure reduction in brake lines <u>front left</u> .
			Malfunction:
			Braking force reading greater than 1100 N
		<u>Trouble-shooting:</u> <ul style="list-style-type: none"> Lamp 2 (red) must not light up. Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests. 	

Continued on H15



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

H13

Test with ABS tester
 BMW 7 series



H14

Test with ABS tester
 BMW 7 series



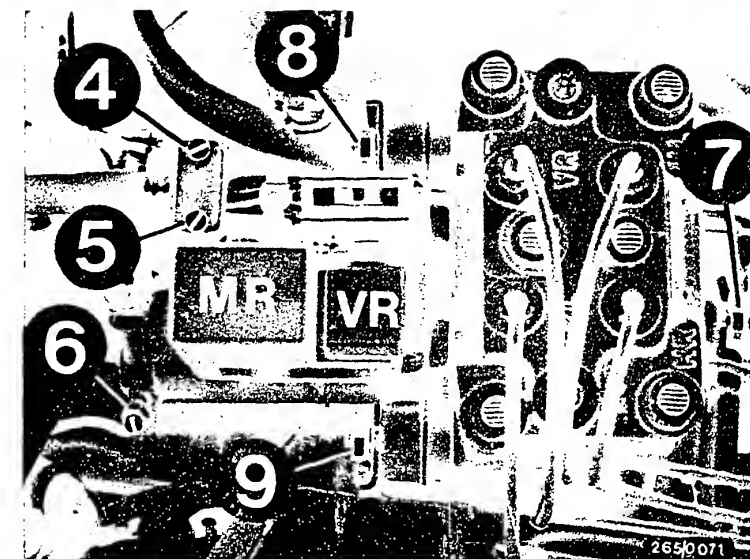
TEST STEP 34

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 35			
Operation:		Reading:	Testing:
Program-selector switch position	20	Instruments on dynamic brake analyzer:	Component:
<u>Additional operations:</u> <ul style="list-style-type: none"> Let the engine run. Select wheel FR with key FR. Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the <u>right-hand side</u>. Brake pedal force must not be changed throughout the entire testing procedure. Left-hand reading may differ by no more than 500 N (50 kgf) from the right-hand reading. Press illuminated key until test is completed (approx. 10 seconds). Read off right-hand reading. Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers). 		Right-hand reading drops to a value below 1100 N (110 kgf)	Hydraulic modulator
		If reading OK, continue testing with next test step.	Operation:
			Pressure reduction in brake lines <u>front right</u>
			Malfunction:
			Braking force reading greater than 1100 N
<u>Trouble-shooting:</u> <ul style="list-style-type: none"> Lamp 2 (red) must not light up. Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests. 			
Continued on H18			



- 4,5= Screws for wiring harness strain relief
6 = Ground terminal for pump motor
7,8,9=Mounting points for hydraulic modulator
MR = Return-pump relay
VR = Valve relay

H16

Test with ABS tester
BMW 7 series



H17

Test with ABS tester
BMW 7 series



TEST STEP 35

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 36

Operation:

Program-selector switch position

21

Additional operations:

- Let the engine run.
- Switch on both brake rollers.
- Select wheel FL with key FL.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the left-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to an intermediate value less than 500 N (50 kgf) and then rises to 1000 ... 1700 N (100...170 kgf).

If reading OK, continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

Pressure buildup in brake lines front left

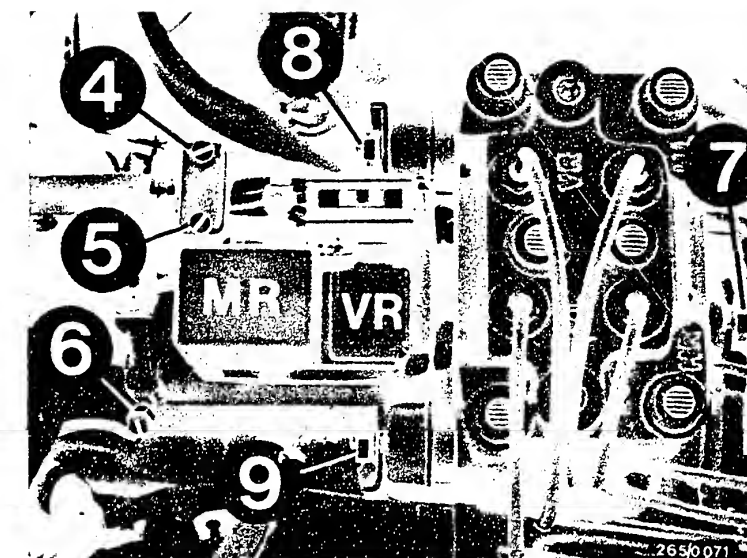
Malfunction:

Braking force reading less than 1000 N or greater than 1700 N

Trouble-shooting:

- Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.

Continued on H21



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

H 19

Test with ABS tester
 BMW 7 series



H 20

Test with ABS tester
 BMW 7 series



TEST STEP 36

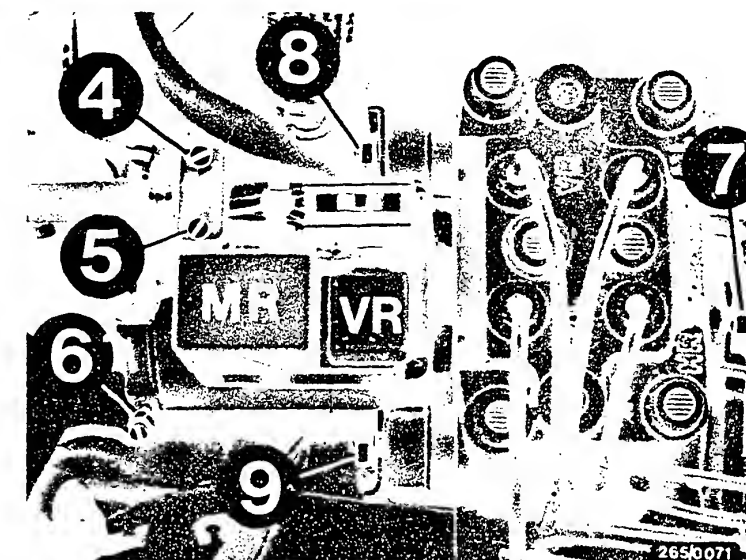
Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

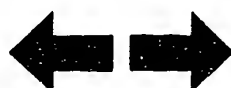


TEST STEP 37			
Operation:		Reading:	Testing:
Program-selector switch position	21	Instruments on dynamic brake analyzer: <u>Right-hand reading drops to an intermediate value less than 500 N (50 kgf) and then rises to 1000 ... 1700 N (100...170 kgf).</u>	<u>Component:</u> Hydraulic modulator
<u>Additional operations:</u> <ul style="list-style-type: none"> Let the engine run. Select wheel FR with key FR. Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the <u>right-hand side</u>. Brake pedal force must not be changed throughout the entire testing procedure. Press illuminated key until test is completed (approx. 10 seconds). Read off right-hand reading. Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers). 		<u>Operation:</u> <u>Pressure buildup in brake lines front right</u>	
		If reading OK, continue testing with next test step.	<u>Malfunction:</u> Braking force reading less than 1000 N or greater than 1700 N
		<u>Trouble-shooting:</u> <ul style="list-style-type: none"> Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests. 	

Continued on H24



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay



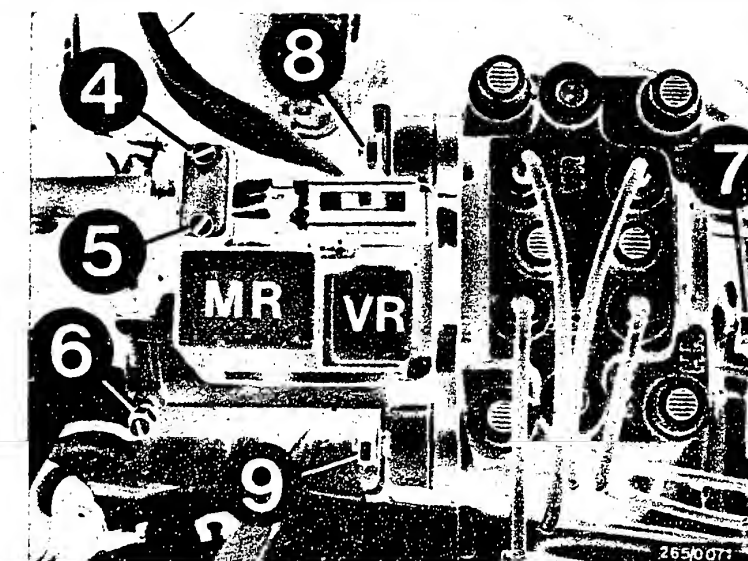
TEST STEP 37

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 38		
Operation:		Reading:
Program-selector switch position	22	Instruments on dynamic brake analyzer:
<u>Additional operations:</u> <ul style="list-style-type: none"> Let the engine run. Switch on both brake rollers. Select wheel FL with key FL. Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the <u>left-hand side</u>. Brake pedal force must not be changed throughout the entire testing procedure. Press illuminated key until test is completed (approx. 10 seconds). Read off left-hand reading. Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers). 		After 2 pressure reductions without return pump, the return pump is switched on briefly. The left-hand braking force reading must then drop <u>below 500 N (50 kgf).</u> Brake pedal comes back slightly when pump switches on. If reading OK, <u>continue testing with next test step.</u>
		<u>Testing:</u> <u>Component:</u> Hydraulic modulator
		<u>Operation:</u> Pump delivery Brake circuit 1
		<u>Malfunction:</u> Braking force reading greater than 500 N



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

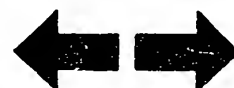
Trouble-shooting:

- Repeat test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.

Continued on J3

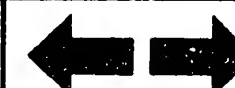
J1

Test with ABS tester
BMW 7 series



J2

Test with ABS tester
BMW 7 series



TEST STEP 38

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 39

Operation:

Program-selector switch position

22

Additional operations:

- Let the engine run.
- Select wheel FR with key FR.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the right-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off right-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

After 2 pressure reductions without return pump, the return pump is switched on briefly.

The right-hand braking force reading must then drop .

below 500 N (50 kgf).

Brake pedal comes back slightly when pump switches on.

If reading OK, continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

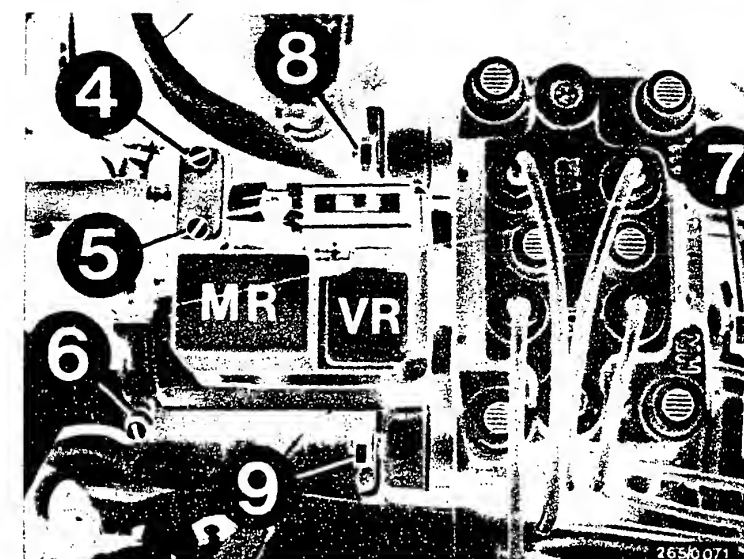
Pump delivery
Brake circuit 2

Malfunction:

Braking force reading greater than 500 N

Trouble-shooting:

- Repeat test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.



- 4,5= Screws for wiring harness strain relief
6 = Ground terminal for pump motor
7,8,9=Mounting points for hydraulic modulator
MR = Return-pump relay
VR = Valve relay

Continued on J6

J4

Test with ABS tester
BMW 7 series



J5

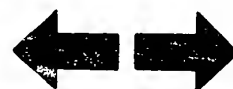
Test with ABS tester
BMW 7 series



TEST STEP 39

Trouble-shooting (continued)

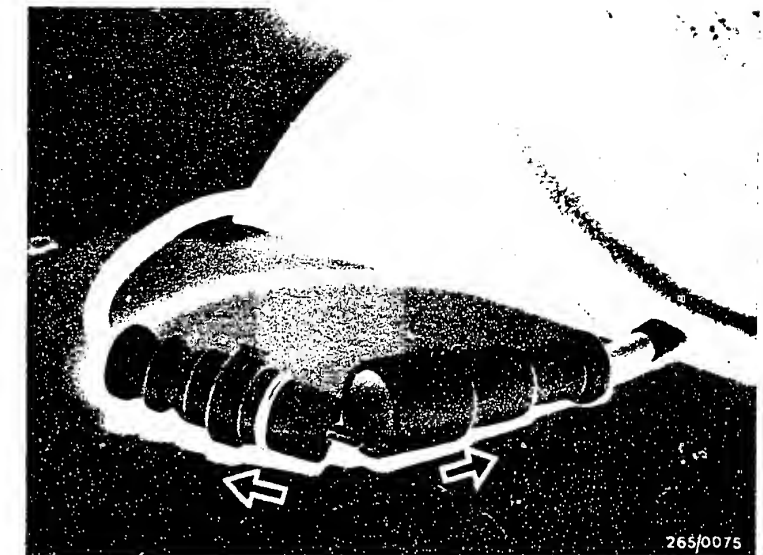
- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



Rear axle - Carry out program-selector switch position 23 first since it is assumed for the following test steps that the wheel-speed sensors are in proper working order.

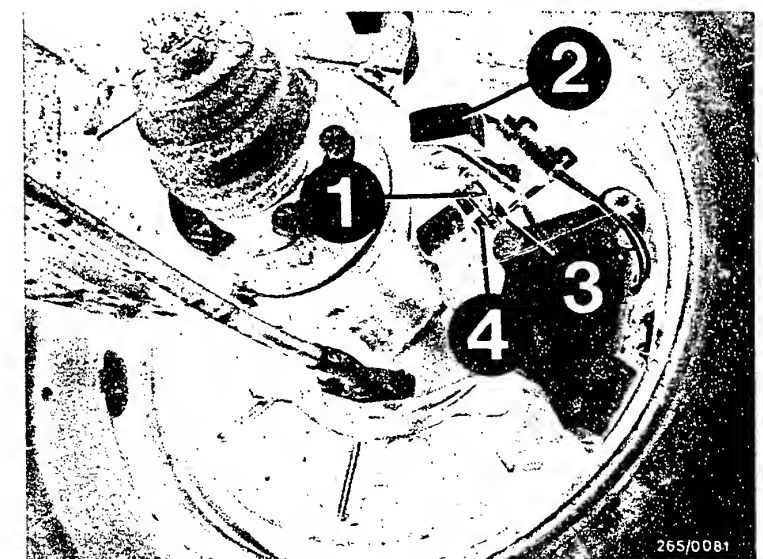
TEST STEP 40

<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	23	Digital display unit must indicate <u>1.9...19 V</u>	<u>Component:</u> Wheel-speed sensor rear left
<u>Additional operations:</u>		In case of fluctuating readings, the lowest reading is valid.	<u>Operation:</u> Wheel-speed sensor signal
<ul style="list-style-type: none"> ● Drive the rear wheels of the vehicle onto the dynamic brake analyzer. ● Switch on the ignition. ● Select wheel RL with key RL. ● Switch on left-hand brake roller. ● Make reading. 		<u>Note:</u> If reading is 1.9 V, check air gap.	<u>Malfunction:</u> Reading less than 1.9 or greater than 19 V.
		If reading OK, continue testing with <u>next test step.</u>	



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



Trouble-shooting (switch off ignition):

- A reading of 999 signifies: speed of dynamic brake analyzer too great (above approx. 13 km/h)

Continued on J9/J10

J7

Test with ABS tester
BMW 7 series



J8

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 40 (continued)

Reading 0 or less than 1.9:

- Wheel-speed sensors mixed up? Check assignment:
Wheel-speed sensors must correspond to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel-bearing play.
- Replace wheel-speed sensor.

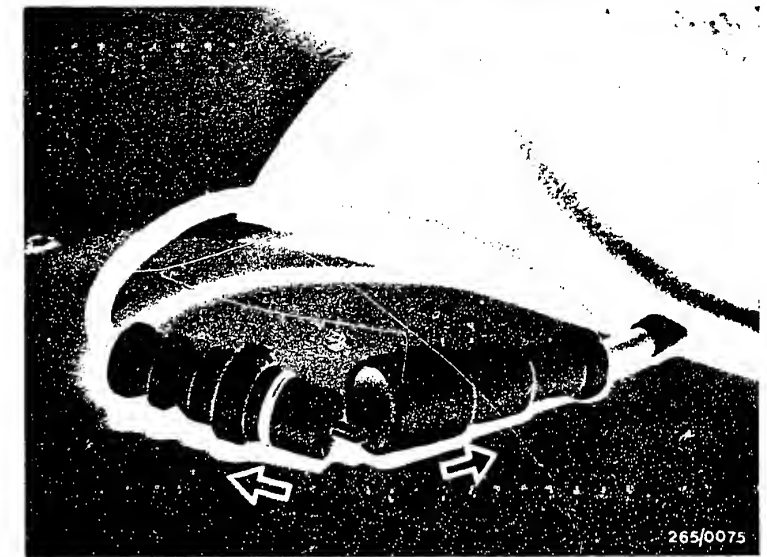
Removing wheel-speed sensors on rear axle

- Rear wheels can be removed to facilitate replacement of the wheel-speed sensors.
- Switch off ignition.
- Remove rear seat.
- Undo plug connector under rear seat.
- Pull out the wheel-speed sensor cable (with connector) to the left-hand or right-hand rear axle as the case may be.
- Push back rubber sleeve (2).
- Loosen hexagon-socket-head cap screw (3) and pull out wheel-speed sensor (1).
Do not use force.

Caution!

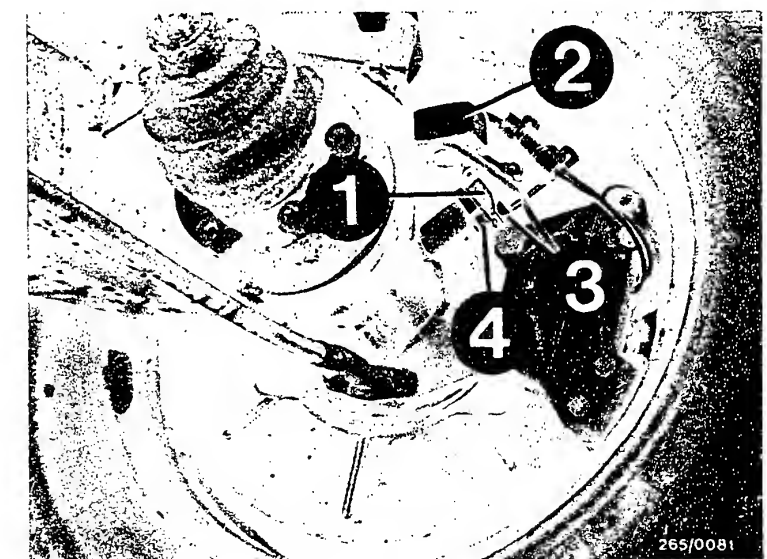
If there are any shim rings (4) on the two rear-axle wheel-speed sensors, do not mix them up. Different thickness possible.

Continued on J11/J12



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



J9

Test with ABS tester
BMW 7 series



J10

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 40 (continued)

Installing wheel-speed sensor on rear axle

Notes on wheel-speed sensors with shim rings:

If re-using the same wheel-speed sensors, make sure that the shim rings of the left-hand and right-hand wheel-speed sensors are not mixed up.

Before installing a new wheel-speed sensor, establish the correct size of shim ring.

Do not install wheel-speed sensors without shim ring. Danger of damage!

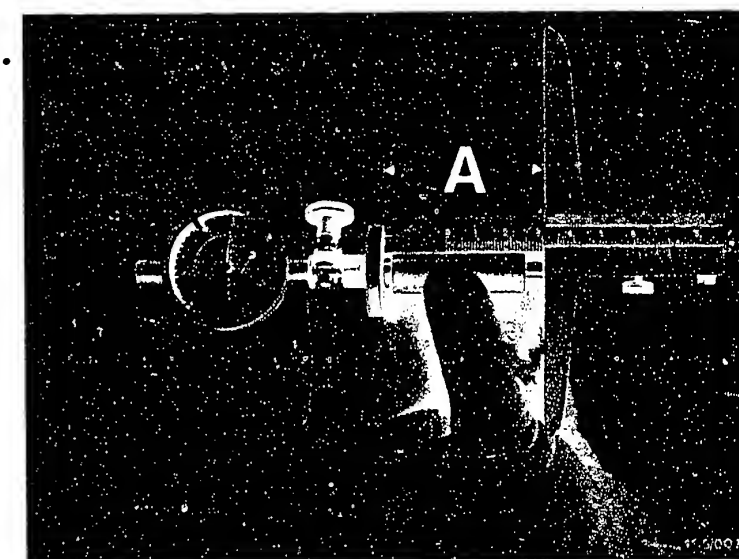
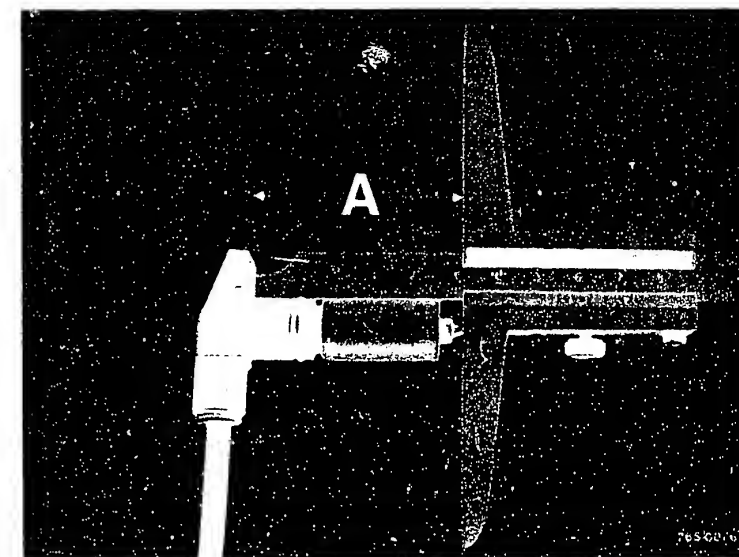
Calculating the air gap

- Using depth calliper, measure dimension "A" on new wheel-speed sensor and make a note. Do not tilt depth calliper.
- Hold depth calliper with dimension "A" against depth gauge with dial indicator and set dial indicator to zero with a slight preload. The installation dimension of the new wheel-speed sensor has now been transferred to the depth gauge.
- Insert depth gauge KDAS 0001 into wheel-speed sensor mounting hole as far as it will go.
- Read off difference and add air gap (0.25 mm). This gives the shim dimension. Choose the shim ring which is nearest in dimension to the shim dimension. Shim rings are in steps of 0.1 mm.

Example:

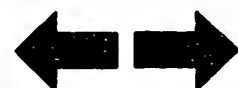
Difference read off on dial indicator: 2.26 mm. Plus 0.25 mm air gap gives 2.51 mm. Install 2.50 mm shim ring (dimensionally the nearest).

Continued on J13/J14



J11

Test with ABS tester
BMW 7 series



J12

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 40 (continued)

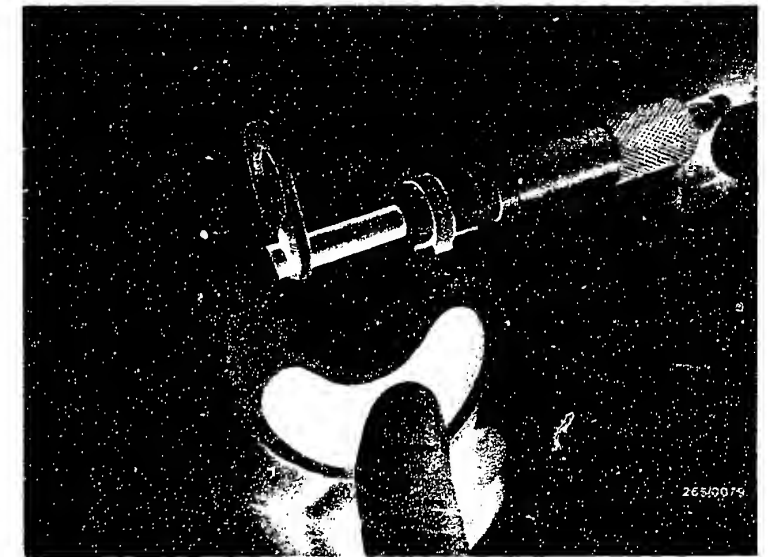
Valid for all models:

- Check O-ring (1) and rubber sleeve (2) for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

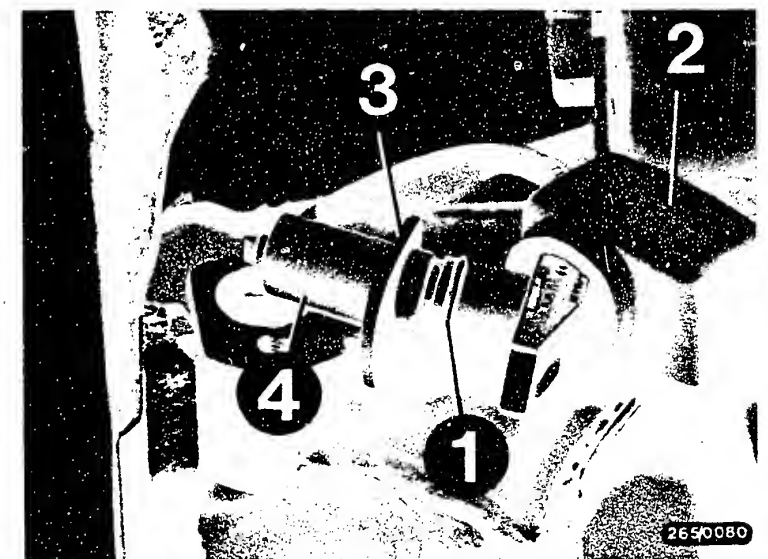
Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Correct shim ring fitted?
Be sure to check thickness of shim ring with micrometer screw.
- Press wheel-speed sensor into mounting hole. Do not hit. Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve properly.
- Run cable under rear seat and connect to wiring harness.
- Fully test ABS with tester.



Measuring the shim ring with micrometer screw

- 1 = O-ring
- 2 = Rubber sleeve
- 3 = Shim ring
- 4 = Wheel-speed sensor housing



J13

Test with ABS tester
BMW 7 series

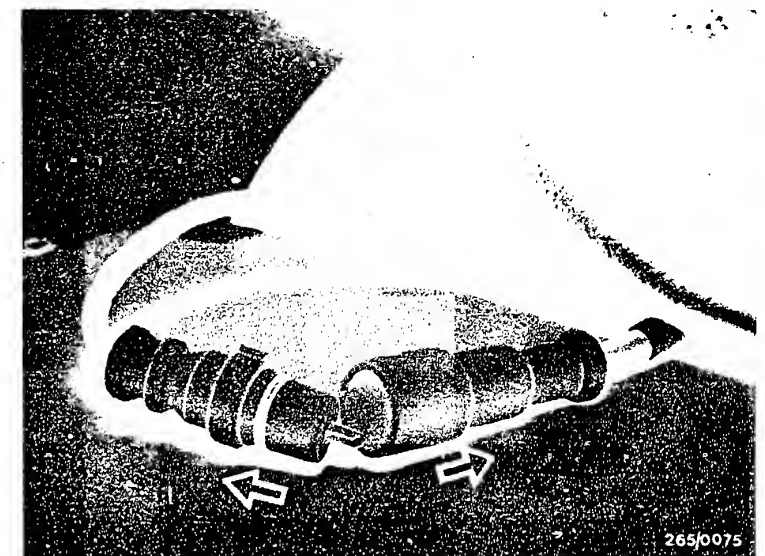


J14

Test with ABS tester
BMW 7 series

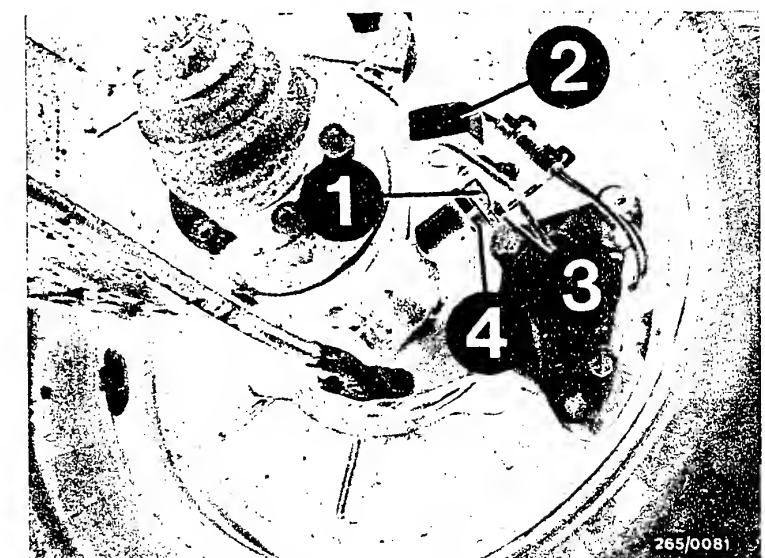


TEST STEP 41		
Operation:		Reading:
Program-selector switch position	23	Digital display unit must indicate <u>1.9...19 V</u>
<u>Additional operations:</u> <ul style="list-style-type: none"> • Drive the rear wheels of the vehicle onto the dynamic brake analyzer. • Switch on the ignition. • Select <u>wheel RR</u> with <u>key RR</u>. • Switch on <u>right-hand brake roller</u> only. • Make reading. 		In case of fluctuating readings, the lowest reading is valid. <u>Note:</u> If reading is 1.9 V, check air gap.
		<u>Operation:</u> Signal and mixing up of connecting cables
		<u>Malfunction:</u> Reading less than 1.9 or greater than 19 V.



Arrows = Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



Trouble-shooting (switch off ignition):

- A reading of 999 signifies: speed of dynamic brake analyzer too great (above approx. 13 km/h)

Continued on J17/J18

J 15

Test with ABS tester
BMW 7 series



J 16

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 41 (continued)

Reading 0 or less than 1.9:

- Wheel-speed sensors mixed up? Check assignment:
Wheel-speed sensors must correspond to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel-bearing play.
- Replace wheel-speed sensor.

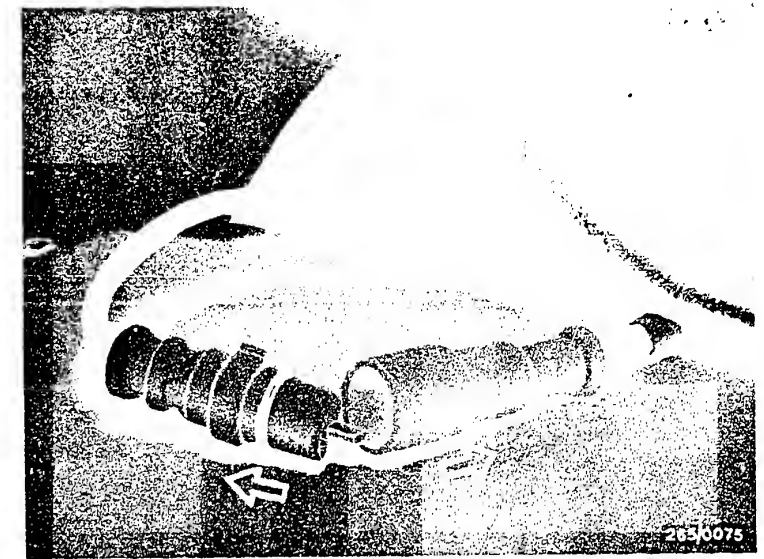
Removing wheel-speed sensors on rear axle

- Rear wheels can be removed to facilitate replacement of the wheel-speed sensors.
- Switch off ignition.
- Remove rear seat.
- Undo plug connector under rear seat.
- Pull out the wheel-speed sensor cable (with connector) to the left-hand or right-hand rear axle as the case may be.
- Push back rubber sleeve (2).
- Loosen hexagon-socket-head cap screw (3) and pull out wheel-speed sensor (1).
Do not use force.

Caution!

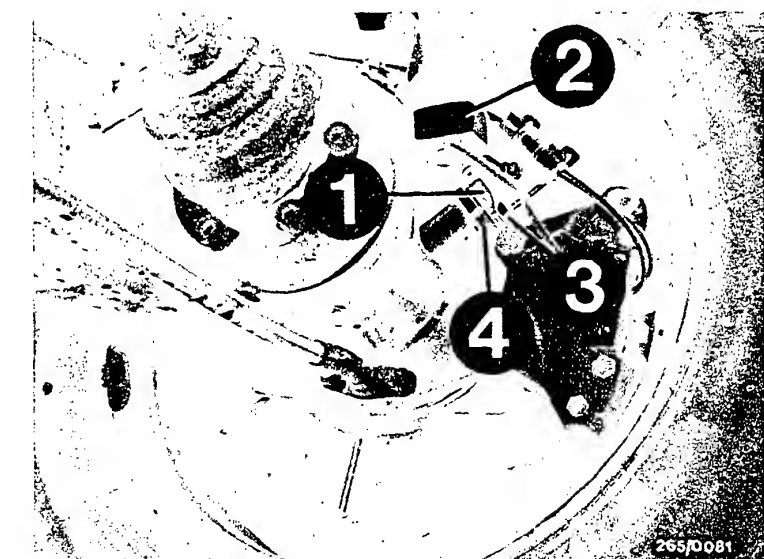
If there are any shim rings (4) on the two rear-axle wheel-speed sensors, do not mix them up. Different thickness is possible.

Continued on J19/J20



Arrows= Wheel-speed sensor plug connector under rear seat

- 1 = Wheel-speed sensor
- 2 = Rubber sleeve
- 3 = Hexagon-socket-head cap screw
- 4 = Shim ring



J17

Test with ABS tester
BMW 7 series



J18

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 41 (continued)

Installing wheel-speed sensor on rear axle

Notes on wheel-speed sensors with shim rings:

If re-using the same wheel-speed sensors, make sure that the shim rings of the left-hand and right-hand wheel-speed sensors are not mixed up.

Before installing a new wheel-speed sensor, establish the correct size of shim ring.

Do not install wheel-speed sensors without shim ring. Danger of damage!

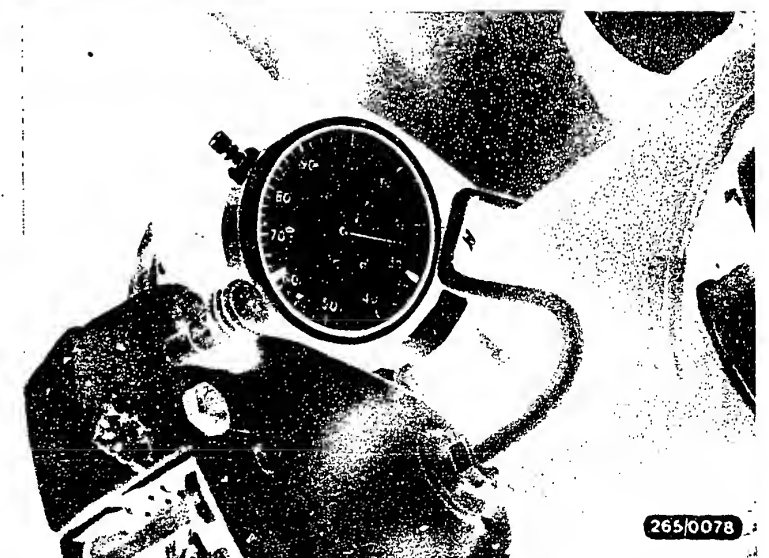
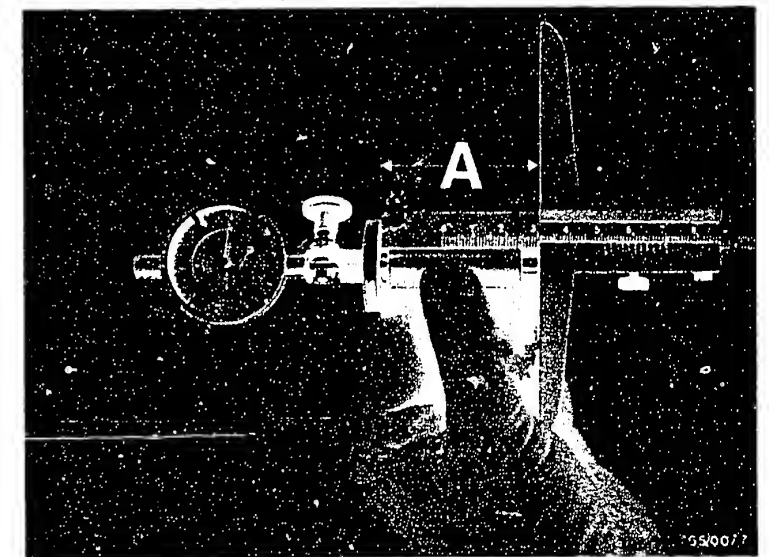
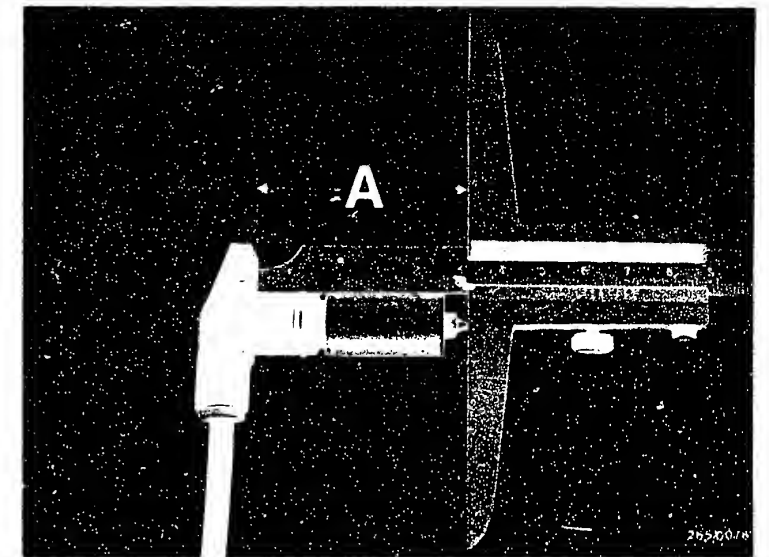
Calculating the air gap

- Using depth calliper, measure dimension "A" on new wheel-speed sensor and make a note. Do not tilt depth calliper.
- Hold depth calliper with dimension "A" against depth gauge with dial indicator and set dial indicator to zero with a slight preload. The installation dimension of the new wheel-speed sensor has now been transferred to the depth gauge.
- Insert depth gauge KDAS 0001 into wheel-speed sensor mounting hole as far as it will go.
- Read off difference and add air gap (0.25 mm). This gives the shim dimension. Choose the shim ring which is nearest in dimension to the shim dimension. Shim rings are in steps of 0.1 mm.

Example:

Difference read off on dial indicator: 2.26 mm. Plus 0.25 mm air gap gives 2.51 mm. Install 2.50 mm shim ring (dimensionally the nearest).

Continued on J21/J22



J19

Test with ABS tester
BMW 7 series



J20

Test with ABS tester
BMW 7 series



Trouble-shooting for TEST STEP 41 (continued)

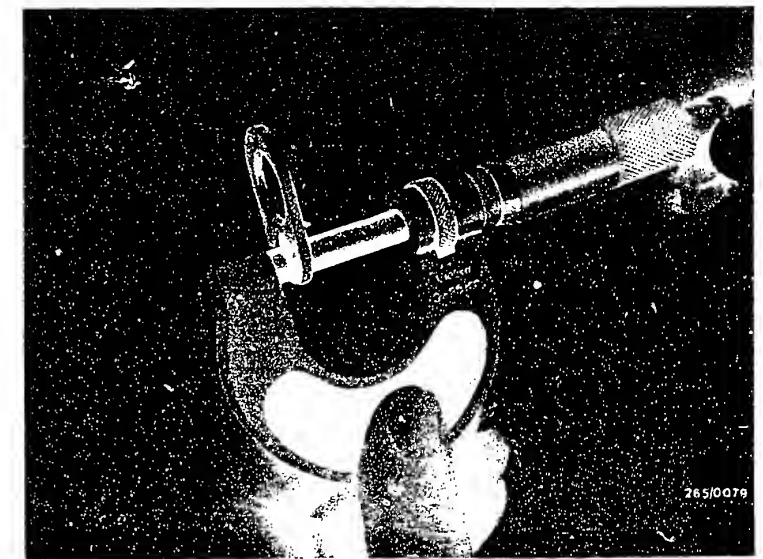
Valid for all models:

- Check O-ring (1) and rubber sleeve (2) for cracks. Replace if necessary.
- Grease wheel-speed sensor housing with Molykote Longterm 2.

Caution!

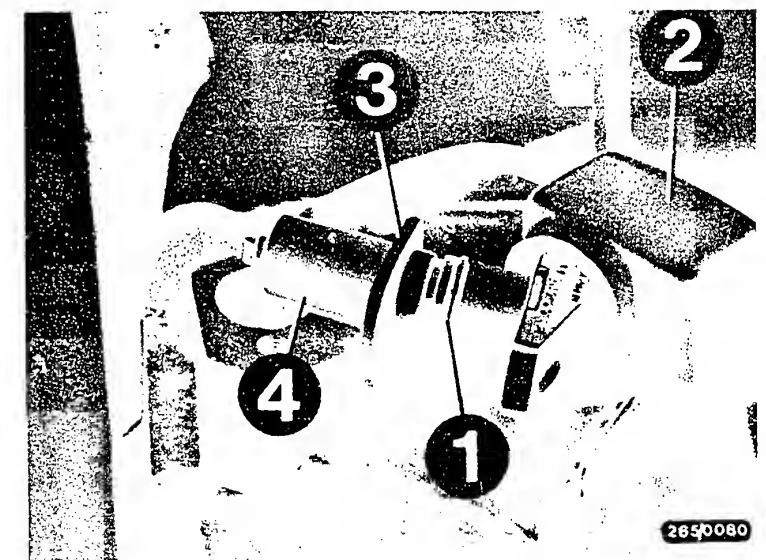
Before installing the wheel-speed sensors, make sure that there are no metallic foreign bodies on the permanently magnetic edges.

- Correct shim ring fitted?
Be sure to check thickness of shim ring with micrometer screw.
- Press wheel-speed sensor into mounting hole. Do not hit. Do not damage O-ring.
- Secure wheel-speed sensor with hexagon-socket-head cap screw.
- Pull over rubber sleeve properly.
- Run cable under rear seat and connect to wiring harness.
- Fully test ABS with tester.



Measuring the shim ring with micrometer screw

- 1 = O-ring
- 2 = Rubber sleeve
- 3 = Shim ring
- 4 = Wheel-speed sensor housing



J21

Test with ABS tester
BMW 7 series



J22

Test with ABS tester
BMW 7 series



TEST STEP 42

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Select test step 20, and select wheel RL with key RL.
- Switch on Left-hand brake roller.
- Using brake pedal, produce a braking force of 2000 N (200 kgf).
- Press illuminated key.
- There must be a pressure reduction on the corresponding wheel (rear left).
- Release brake pedal and illuminated key.
(Follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to a value

below 1100 N (110 kgf).

If reading OK, continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat test.
Wait at least 20 sec. between tests.
- Brake lines mixed up on hydraulic modulator?
Follow markings.
- Check assignment of brake roller to keys RR and RL once again.

Testing:

Component:

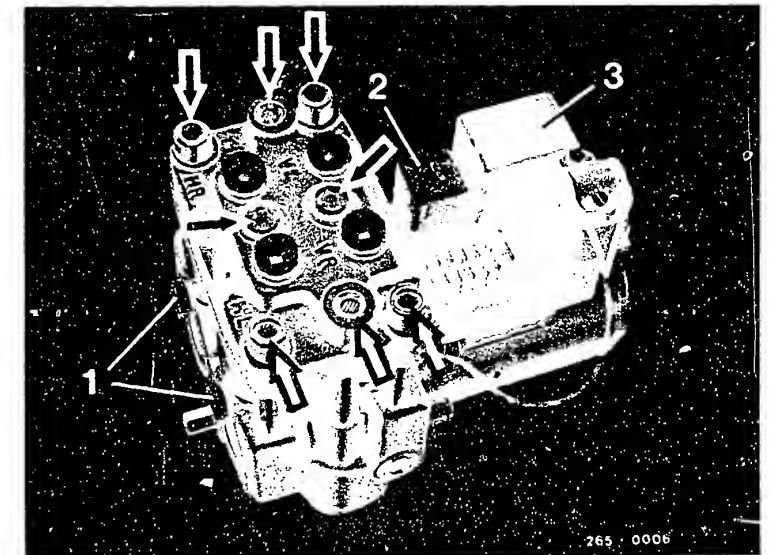
Hydraulic modulator, rear axle

Operation:

Mixing up of brake lines

Malfunction:

Reading does not drop



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay
- VL= Connection for brake line front left (wheel brake cyl.)
- VR= Connection for brake line front right (wheel brake cyl.)
- HR= Connection for brake line rear right (wheel brake cyl.)
- HL= Connection for brake line rear left (wheel brake cyl.)

Caution!

Under no circumstances may the hexagon-socket-head cap screws (arrows) be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.

Danger!

K1

Test with ABS tester

BMW 7 series



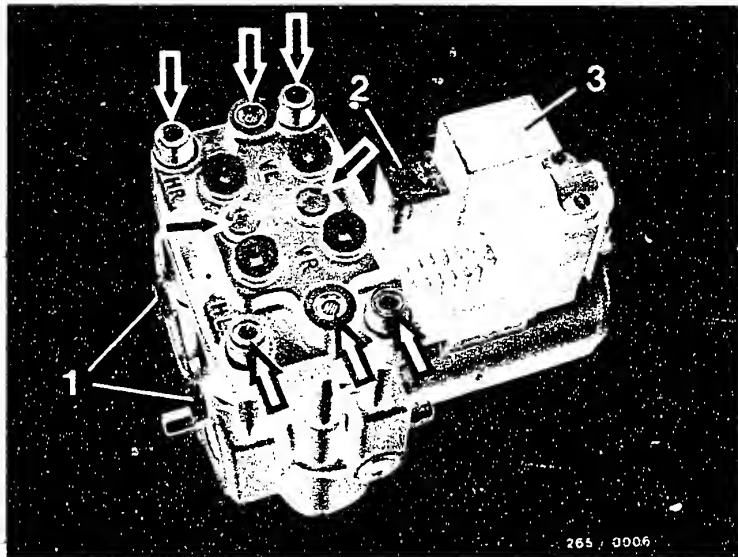
K2

Test with ABS tester

BMW 7 series



TEST STEP 43			
Operation:		Reading:	Testing:
Program-selector switch position	20	Instruments on dynamic brake analyzer:	Component: Hydraulic modulator, rear axle
<u>Additional operations:</u> <ul style="list-style-type: none"> Let the engine run. Switch off left-hand brake roller. Switch on right-hand brake roller. Select wheel RR with key RR. Using brake pedal, produce a braking force of <u>2000 N</u> (200 kgf). Press illuminated key. There must be a pressure reduction on the corresponding wheel (front right). Release brake pedal and illuminated key. (Follow the sequence of operations so that the vehicle does not jump out of the rollers). 		Right-hand reading drops to a value below 800 N (80 kgf).	Operation: Mixing up of brake lines
		If reading OK, continue testing with next test step.	Malfunction: Reading does not drop
		<u>Trouble-shooting:</u> <ul style="list-style-type: none"> Lamp 2 (red) must not light up. Repeat test. Wait at least 20 sec. between tests. Brake lines mixed up on hydraulic modulator? Follow markings. Check assignment of brake roller to keys RR and RL once again. 	



- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay
- VL= Connection for brake line front left (wheel brake cyl.)
- VR= Connection for brake line front right (wheel brake cyl.)
- HR= Connection for brake line rear right (wheel brake cyl.)
- HL= Connection for brake line rear left (wheel brake cyl.)

Caution!
Under no circumstances may the hexagon-socket-head cap screws (arrows) be loosened.
After loosening, it is no longer possible to get the brake circuits leak-tight.
Danger!

TEST STEP 44

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Switch on left-hand and right-hand brake rollers.
- Select wheel RL with key RL.
- Press the brake pedal until the instrument on the dynamic brake analyzer indicates 2000 N (200 kgf) for the left-hand side.

Brake pedal force must not be changed throughout the entire measuring procedure.

- Right-hand reading may differ by no more than 500 N (50 kgf) from the left-hand reading.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to a value

below 1100 N (110 kgf).

If reading OK, continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

Pressure reduction in brake lines rear left.

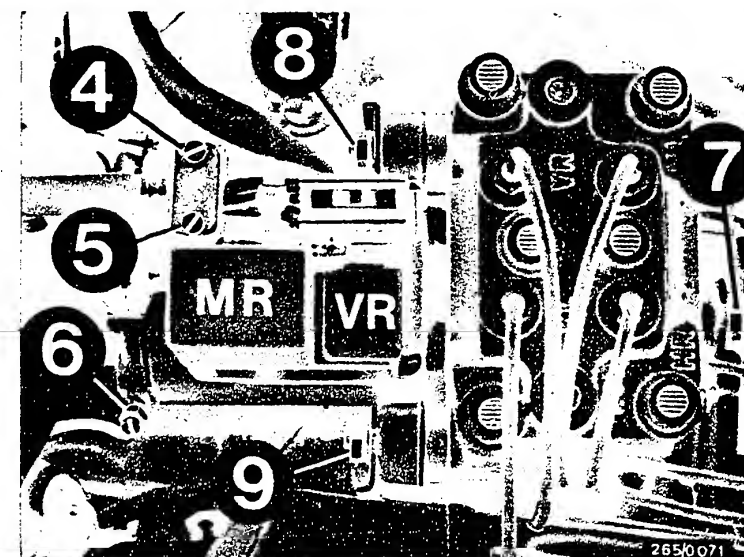
Malfunction:

Braking force reading greater than 1100 N

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.

Continued on K7



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

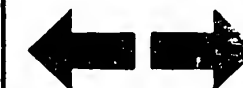
K5

Test with ABS tester
 BMW 7 series



K6

Test with ABS tester
 BMW 7 series



TEST STEP 44

Trouble-shooting (continued)

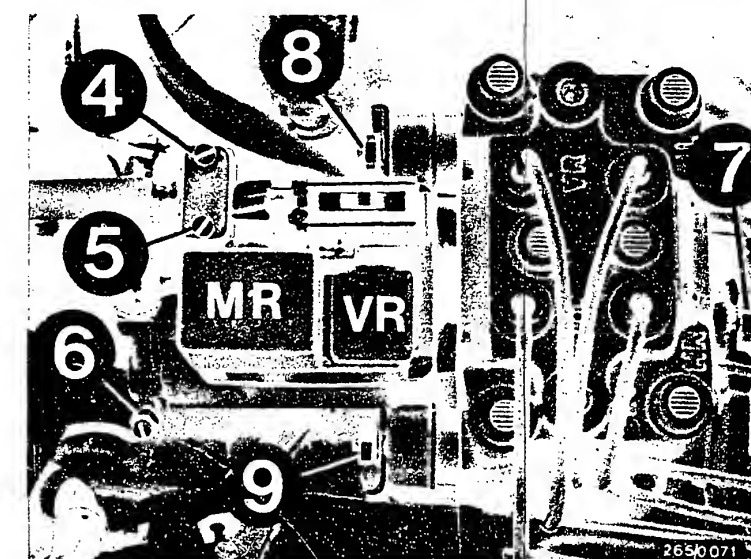
- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

K7

Test with ABS tester
BMW 7 series



TEST STEP 45			
Operation:		Reading:	Testing:
Program-selector switch position	20	Instruments on dynamic brake analyzer: Right-hand reading drops to a value <u>below 1100 N (110 kgf)</u>	<u>Component:</u> Hydraulic modulator
<u>Additional operations:</u> <ul style="list-style-type: none">● Let the engine run.● Select <u>wheel RR</u> with <u>key RR</u>.● Press brake pedal until instrument on dynamic brake analyzer indicates <u>2000 N (200 kgf)</u> for the <u>right-hand side</u>.● Brake pedal force must not be changed throughout the entire testing procedure.● Left-hand reading may differ by no more than 500 N (50 kgf) from the right-hand reading.● Press illuminated key until test is completed (approx. 10 seconds).● Read off right-hand reading.● Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).		If reading OK, continue testing with <u>next test step</u> .	<u>Operation:</u> Pressure reduction in brake lines <u>rear right</u> .
			<u>Malfunction:</u> Braking force reading greater than 1100 N
		<u>Trouble-shooting:</u> <ul style="list-style-type: none">● Lamp 2 (red) must not light up.● Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.	
Continued on K10			



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

K8

Test with ABS tester
BMW 7 series



K9

Test with ABS tester
BMW 7 series



TEST STEP 45

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 46

Operation:

Program-selector switch position

21

Additional operations:

- Let the engine run.
- Switch on both brake rollers.
- Select wheel RL with key RL.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the left-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to an intermediate value less than 500 N (50 kgf) and then rises to 800 ... 1500 N (80 ... 150 kgf).

If reading OK, continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

Pressure buildup in brake lines rear left.

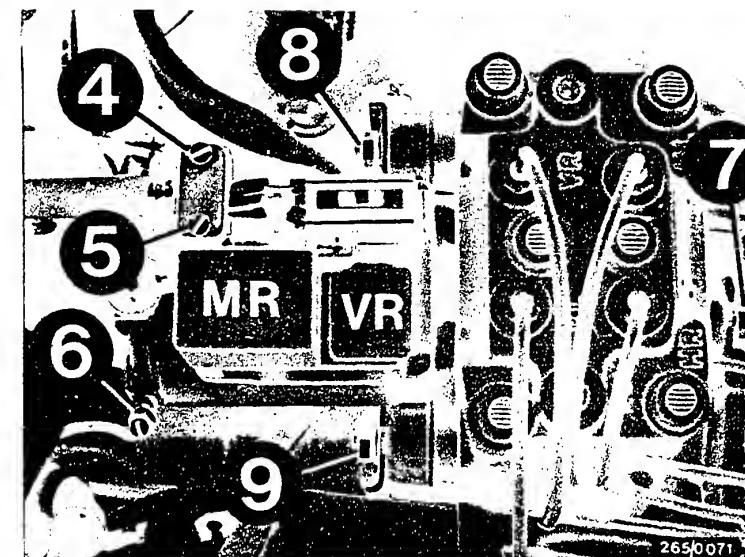
Malfunction:

Braking force reading less than 800 N or greater than 1500 N

Trouble-shooting:

- Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.

Continued on K13



- 4,5= Screws for wiring harness strain relief
- 6 = Ground terminal for pump motor
- 7,8,9=Mounting points for hydraulic modulator
- MR = Return-pump relay
- VR = Valve relay

K11

Test with ABS tester

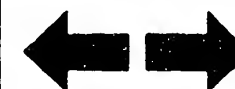
BMW 7 series



K12

Test with ABS tester

BMW 7 series



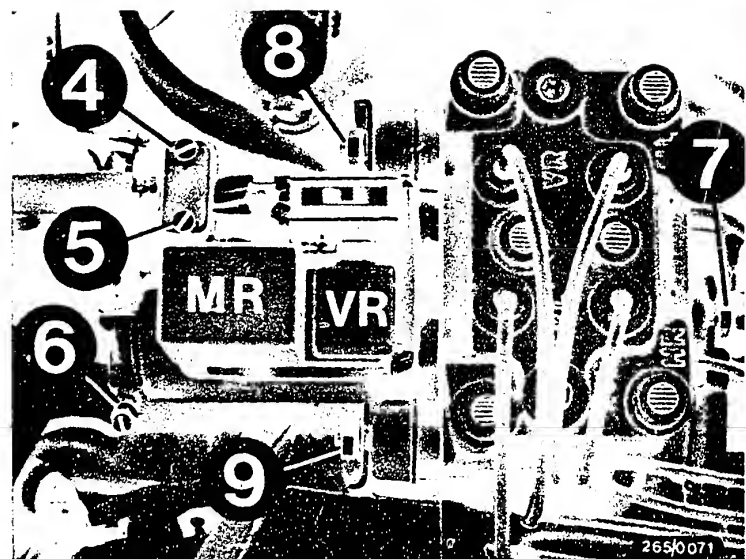
TEST STEP 46

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 47			
Operation:		Reading:	Testing:
Program-selector switch position	21	Instruments on dynamic brake analyzer: Right-hand reading drops to an intermediate value less than 500 N (50 kgf) and then rises to 800 ... 1500 N (80 ... 150 kgf). If reading OK, continue testing with next test step.	<u>Component:</u> Hydraulic modulator <u>Operation:</u> Pressure buildup in brake lines rear right <u>Malfunction:</u> Braking force reading less than 800 N or greater than 1500 N
<u>Additional operations:</u> <ul style="list-style-type: none">● Let the engine run.● Select wheel RR with key RR.● Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the right-hand side.● Brake pedal force must not be changed throughout the entire testing procedure.● Press illuminated key until test is completed (approx. 10 seconds).● Read off right-hand reading.● Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).		<u>Trouble-shooting:</u> <ul style="list-style-type: none">● Repeat the test twice and make sure that the braking force is not changed during the testing procedure. Wait at least 20 seconds between tests.	
Continued on K16			



- 4,5= Screws for wiring harness strain relief
 6 = Ground terminal for pump motor
 7,8,9=Mounting points for hydraulic modulator
 MR = Return-pump relay
 VR = Valve relay

TEST STEP 47

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

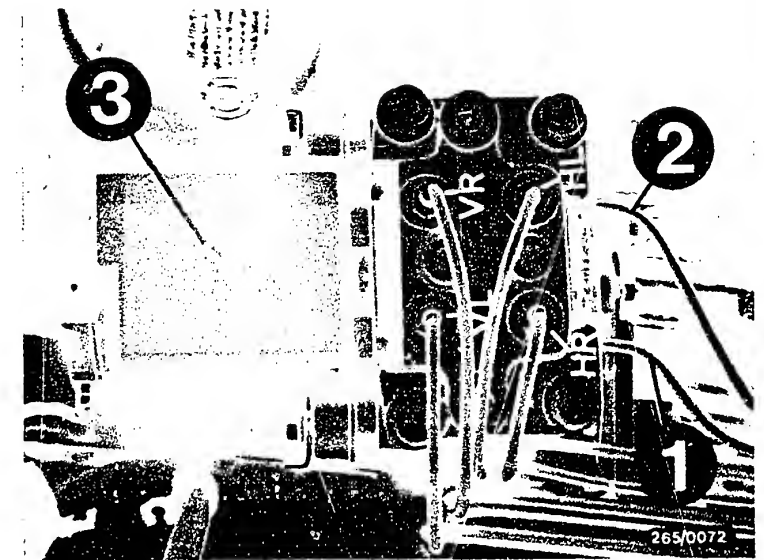


Replacing the hydraulic modulator
(applies to test steps 32...39 and 41...47)

Removing the hydraulic modulator

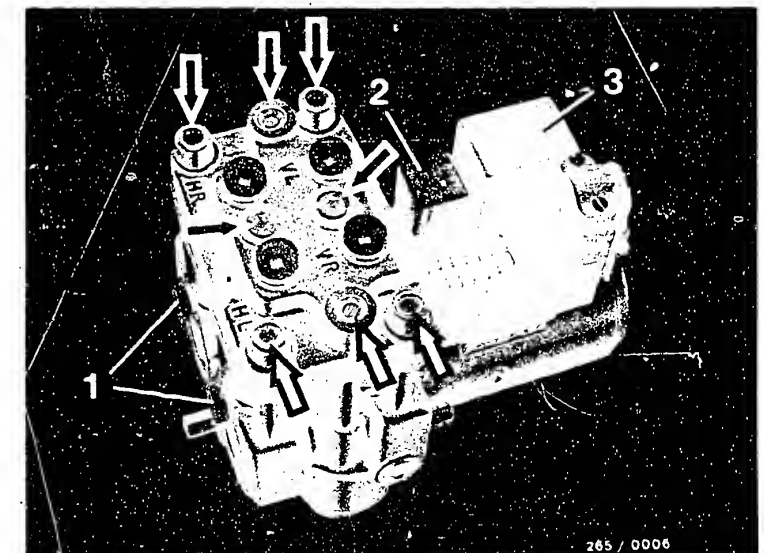
- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake-line connections, it is not permissible to loosen any screws on the hydraulic modulator. In particular the hexagon-socket-head cap screws (bottom picture - arrows) may under no circumstances be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12...16 Nm) or replace, or replace the hydraulic modulator.

Continued on K19/K20



- 1 = Brake line to front brake master cylinder
- 2 = Brake line to rear brake master cylinder
- 3 = Screw for lid

- 1 = Connection points for brake lines to brake master cylinder
- 2 = Valve relay
- 3 = Return-pump relay



K17

Test with ABS tester
BMW 7 series



K18

Test with ABS tester
BMW 7 series



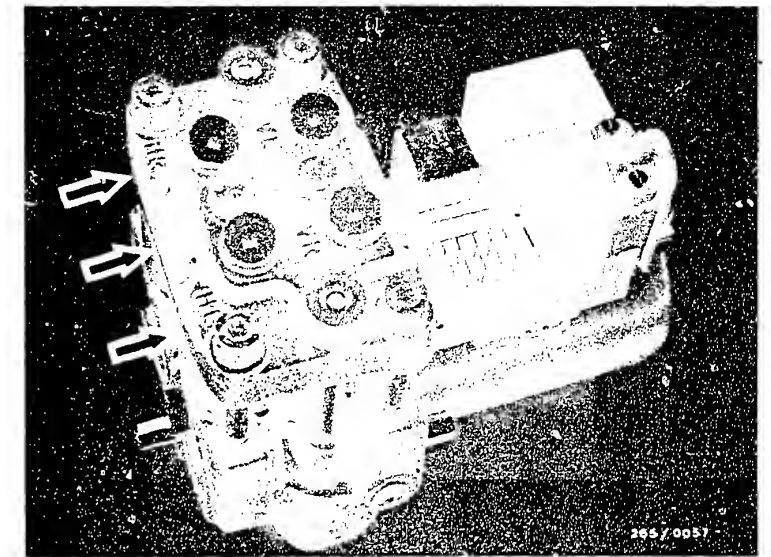
Replacing the hydraulic modulator (continued)

Pay particular attention to the joint identified by 3 arrows (picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid is possible at this point.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. FL of hydraulic modulator must be connected to the front left wheel brake cylinder).
- Markings on hydraulic modulator

VL = Connection for brake line front left (wheel brake cylinder)
VR = Connection for brake line front right (wheel brake cylinder)
HR = Connection for brake line rear right (wheel brake cylinder)
HL = Connection for brake line rear left (wheel brake cylinder)



Continued on K21/K22

K19

Test with ABS tester
BMW 7 series



K20

Test with ABS tester
BMW 7 series

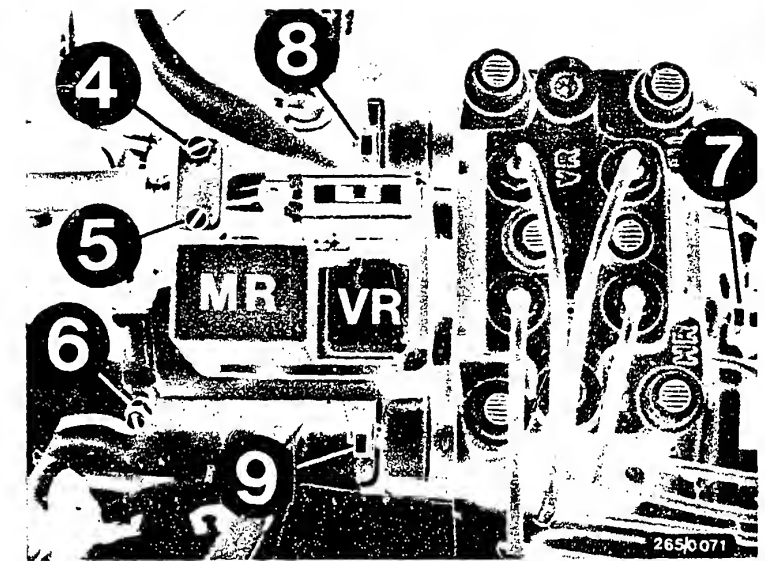


Replacing the hydraulic modulator (continued)

- Use only the specified double-end flare nut wrench 9x11 mm for loosening and tightening the brake lines.
- Mark brake lines and remove from hydraulic modulator.
- Catch the brake fluid and do not bring it into contact with your skin or clothing or with paintwork.
- Immediately seal the brake lines and connections with dummy plugs.
- Disconnect ground cable (6) from pump motor.
- Loosen fastening screw and remove cover.
- Loosen bracket (4, 5) and remove plug.
- Loosen hexagon nuts from holder (7,8,9) and remove hydraulic modulator.

Installation

- Mount hydraulic modulator in the holder and fasten with the hexagon nuts.
- Connect ground cable to pump motor. Plug on 13-pin plug and fasten with the bracket.
- Fasten cover on the hydraulic modulator with the screw.
- Connect the brake lines to the hydraulic modulator in accordance with the markings.
- Observe the tightening torque for the brake-line connections on the hydraulic modulator: 12...16 Nm.
- Bleed the brake system and check for leaks.
- Fully test the ABS with tester.



4 and 5 = Screws for wiring harness strain relief
6 = Ground terminal for pump motor
7,8 and 9 = Fastening points for hydraulic modulator
MR = Return-pump relay
VR = Valve relay

K21

Test with ABS tester
BMW 7 series



K22

Test with ABS tester
BMW 7 series



TEST STEP 48

Operation:

Program-selector switch position

24

Operation in vehicle:

Switch on ignition.
Press brake pedal.

Test specification reached?

Reading:

Digital display unit must indicate

10...15 V.

Testing:

Component:

Stop-lamp switch

Operation:

Signal

Malfunction:

Reading less than 10 V

Yes

No

Testing with the ABS tester completed.
As a final test take the vehicle for a trial run:
With the engine running, indicator lamp must go out.
Drive at min. 30 km/h.
Indicator lamp must not light up again.

Note: Tester must be converted for generation 2B.

Trouble-shooting:

No reading: Check stop-lamp switch including plug connectors and cables.
Reading less than 10 V: Stop lamps defective, eliminate contact resistances at plug connectors or replace stop-lamp switch.

K23

Test with ABS tester

BMW 7 series



K24

Test with ABS tester

BMW 7 series



After-sales Service

Motor Vehicle Service Information

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BMW SERIES 7 MODEL
Antiskid System (ABS)

VDT-I-BMW 040 En
9.1981

New control unit 0 265 100 008 for vehicles
with lightweight rear axle

With the introduction of the new lightweight rear axle as from about September 1981, the new control unit 0 265 100 008 has also been used. The modified wheel suspension together with a more comfortable driving behaviour led to the control unit having to be adapted.

Control unit 0 265 100 006 will not therefore be used in this series any more.

Please note

Important instructions on exchanging the control units.
The new control unit 0 265 100 008 replaces all previous BMW designs.
The existing control unit types must not be fitted into vehicles with the lightweight rear axle. This also applies to the predecessor type 0 265 100 006.

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Technical Bulletins

BMW 7 series



After-sales Service

Technical Bulletin

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NO REPAIRS PERMITTED ON
ABS HYDRAULIC MODULATOR

26

VDT-I-265/102 En
1.1980

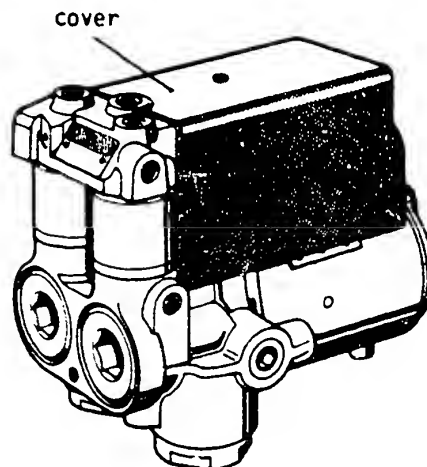
In all technical descriptions attention is drawn to the fact that ABS is a piece of safety equipment. As for all safety equipment in motor vehicles special legal specifications also apply to ABS. This is to prevent the faultless functioning of these systems being impeded by unqualified handling.

With ABS the hydraulic modulator in particular is a component which can be damaged by such tampering.

We would point out that the hydraulic modulator must under no circumstances be repaired. For safety reasons it must be exchanged as a complete unit.

It is only permitted to exchange the motor and valve relay after removing the cover (see picture).

All other screws and plugs, whether with locking paint or not, must not be removed.



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Technical Bulletins

BMW 7 series



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- 5 -

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Technische Mitteilung
BMW 7er - Modelle



ABS Kundendienststellen



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L7

Technische Mitteilung

BMW 7er - Modelle



Kundendienst KH

Technische Mitteilung

Nur zum internen Gebrauch. Weitergabe an Dritte nicht gestattet.

REPARATURVERBOT FÜR
ABS-HYDRAULIKAGGREGAT

26
VDT-I-265/102 De
1.1980

In allen technischen Beschreibungen wird darauf hingewiesen, daß es sich beim ABS um eine Sicherheitsausrüstung handelt. Wie für alle Sicherheitsausrüstungen im Kraftfahrzeug, so gelten auch für ABS besondere gesetzliche Vorschriften. Dadurch soll verhindert werden, daß durch unqualifizierte Eingriffe die einwandfreie Funktion dieser Anlagen beeinträchtigt wird.

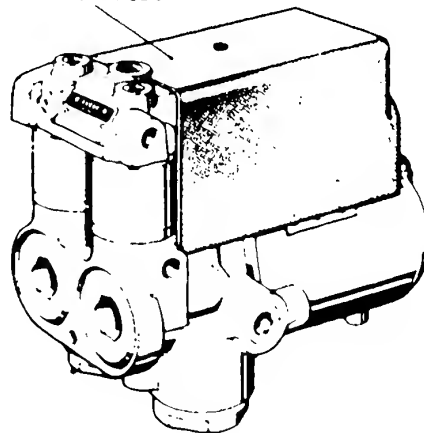
Beim ABS ist besonders das Hydraulik-Aggregat eine Baugruppe, die durch derartige Eingriffe gefährdet ist.

Wir weisen darauf hin, daß das Hydraulikaggregat unter keinen Umständen repariert, sondern aus Sicherheitsgründen nur komplett ausgetauscht werden darf.

Zulässig ist nur der Austausch von Motor- und Ventilrelais nach Abnahme der Abdeckhaube (siehe Bild).

Alle übrigen Schrauben und Verschlußstopfen, ob mit oder ohne Sicherungslack, dürfen nicht gelöst werden.

Abdeckhaube



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Technische Mitteilung

BMW 7er - Modelle



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